DATAMATION 59

November / December

EASTERN JOINT COMPUTER CONFERENCE

DEC 1959

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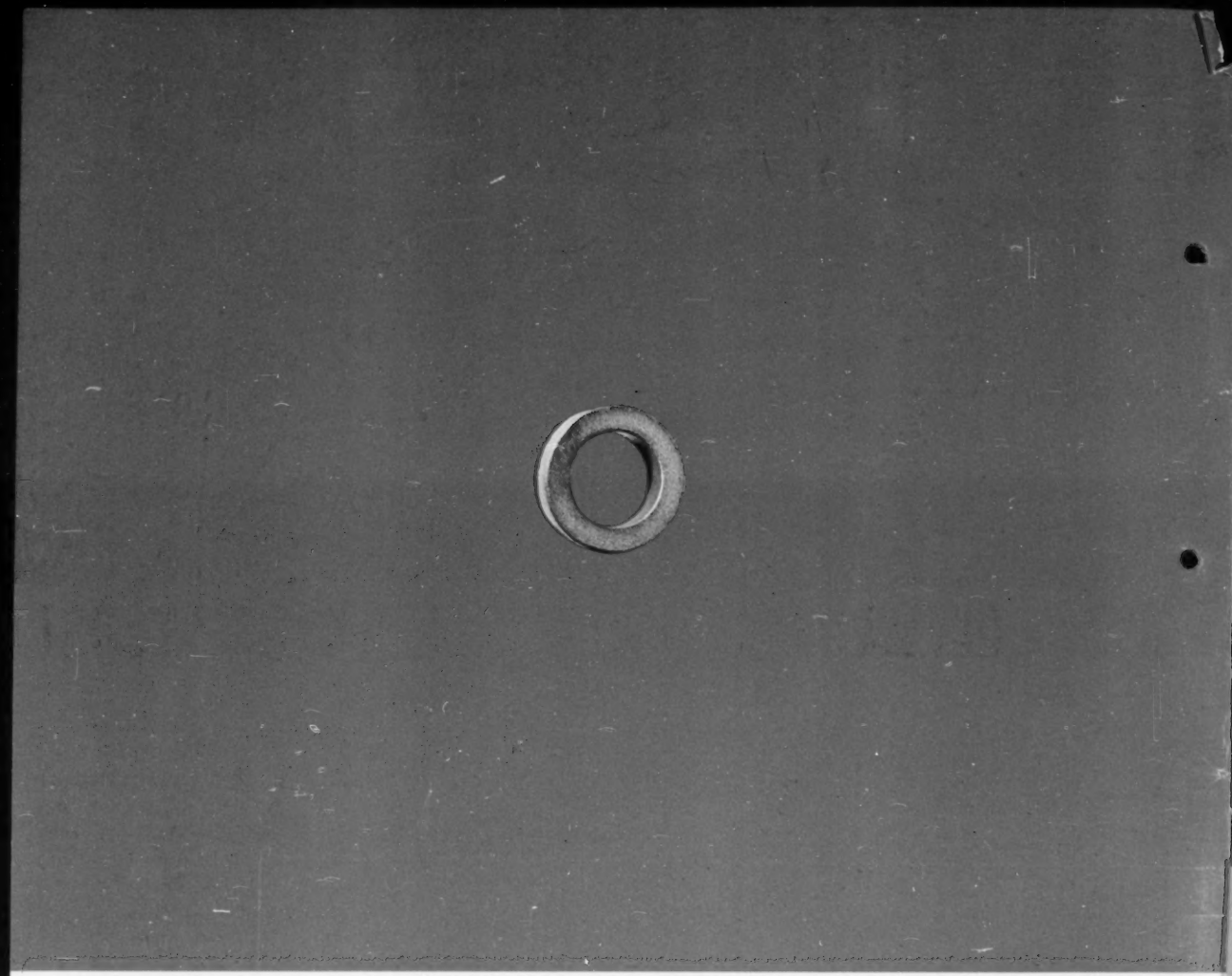

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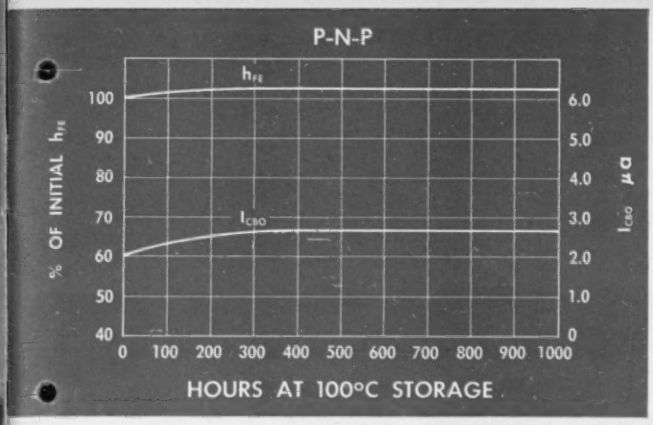

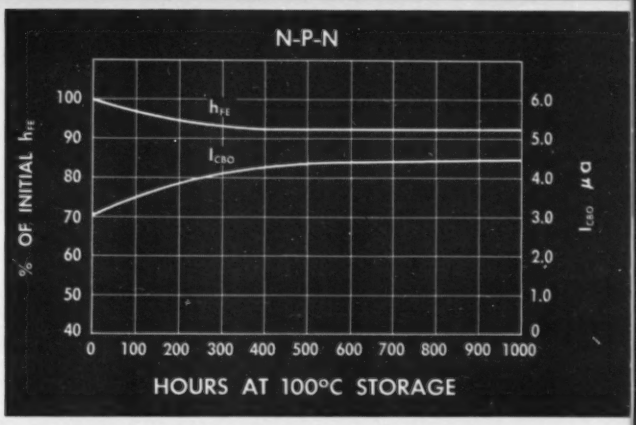

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									V_E=25v, I_C=0		V_C=25v, I_E=0		I_C=10ma, V_{CE}=1v		I_C=200ma, V_{CE}=0.35v		V_{CB}=5v, I_E=−1ma		V_{CB}=5v, f=1mc	
									Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
2N1302	N-P-N	25	25	25	300	−300				6		6	20		10		3			20
2N1303	P-N-P	−25	−30	−25	−300	300				−6		−6	20		10		3			20
2N1304	N-P-N	25	25	20	300	−300				6		6	40	200	15		5			20
2N1305	P-N-P	−25	−30	−20	−300	300	−65 to 100	150		−6		−6	40	200	15		5			20
2N1306	N-P-N	25	25	15	300	−300				6		6	60	300	20		10			20
2N1307	P-N-P	−25	−30	−15	−300	300				−6		−6	60	300	20		10			20
2N1308	N-P-N	25	25	15	300	−300				6		6	80		20		15			20
2N1309	P-N-P	−25	−30	−15	−300	300				−6		−6	80		20		15			20
	Units	v	v	v	ma	ma	°C	mw	μa		μa						mc		μμf	

* Derate at 2.5 mw/°C increase in ambient temperature over 25°C.

† Conditions listed apply to N-P-N. Negative values used for P-N-P.

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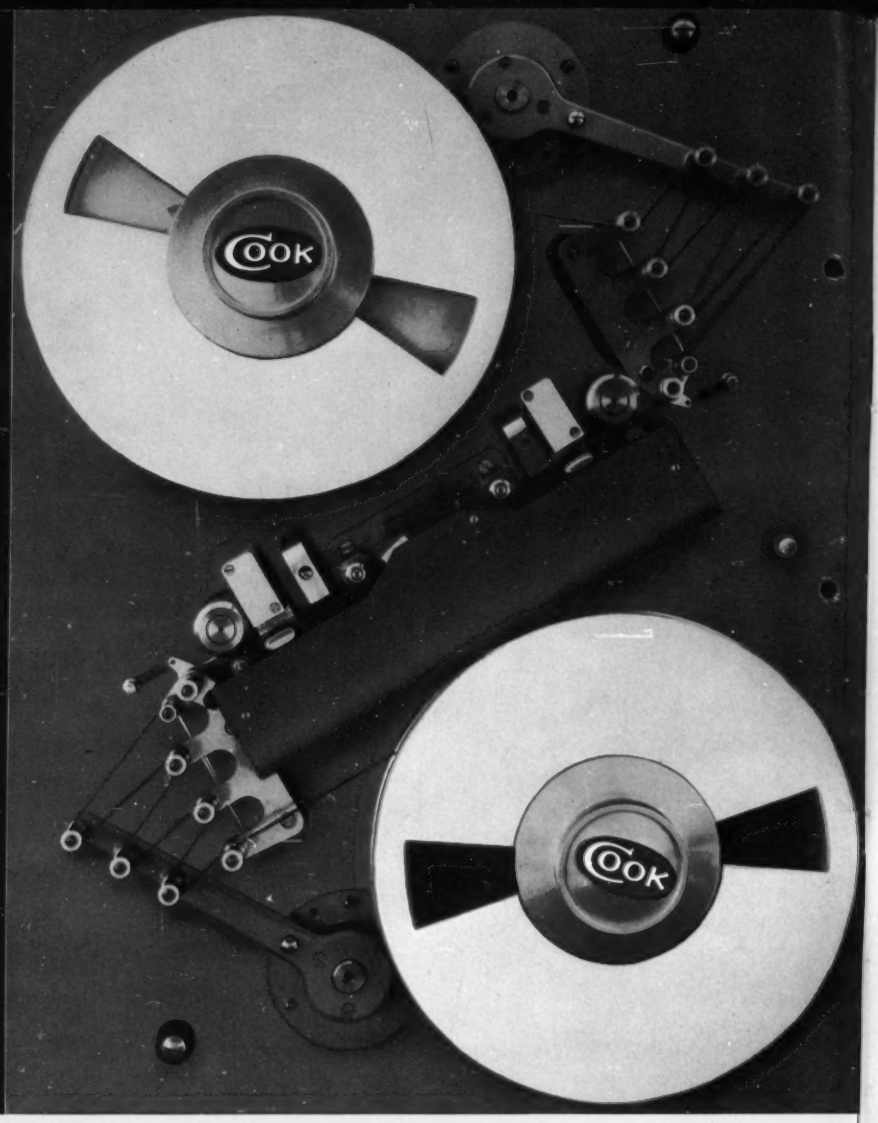

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DATAMATION 59

the automatic handling of information

volume 5, number **6**

November/December 1959

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EASTERN JOINT COMPUTER CONFERENCE

ARTICLES

DEPARTMENTS

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DATAMATION will accept and consider articles dealing with small, medium and large electronic data processing systems; articles covering development and application of components, subsystems and systems; and other general articles of interest to those in the data processing industry. Material submitted should be accompanied by pictures and illustrations when possible. Unsolicited manuscripts to be returned to writer should include return postage but editor assumes no responsibility for their safety (although all reasonable care will be taken).

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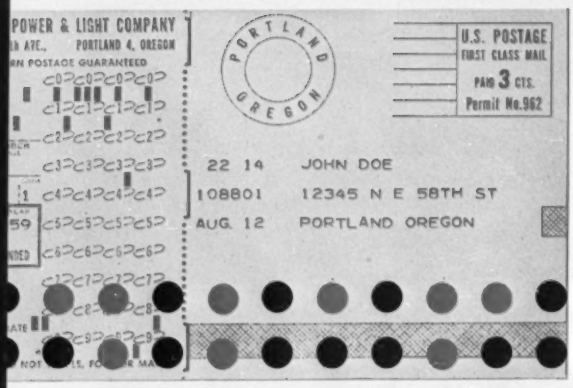
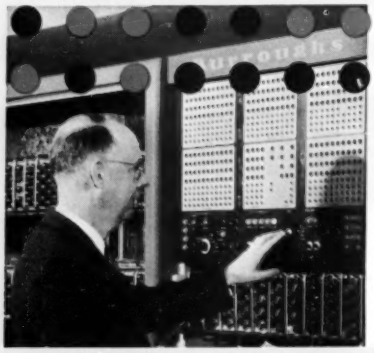
A Statement from Pacific Power & Light:

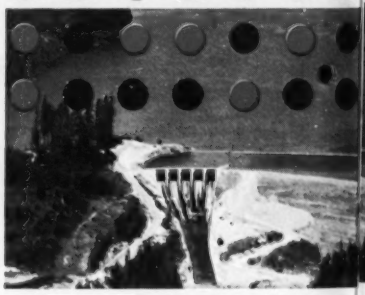
"Our Burroughs 205 computer saves us money in many ways..."



Paul B. McKee, Chairman of the Board and Don C. Frisbee, Treasurer



Programming Head Vern C. Thomas



"Our Burroughs 205 computer saves us money in many ways . . . Customer Billing, Accounting, Plant Expansion Studies, and Area and Resource Development."

PAUL B. MCKEE
Chairman of the Board, Pacific Power & Light

In many ways, a Burroughs 205 electronic data processing system is serving over 300,000 customers in the Great Northwest. The system is installed at Pacific Power & Light in Portland, Oregon, and is currently being used for accounting and engineering jobs.

In 1948 the billing at Pacific Power & Light was centralized on key-driven equipment. Three years later, a forward-thinking management initiated studies of the electronic data processing field. Stanford Research Institute was called in to work with key PP&L accounting personnel in doing a study. After an exhaustive report on computer requirements prepared in 1956, management was ready to make a selection. States PP&L's Chairman of the Board Paul B. McKee, *"We were satisfied that we had researched the problem thoroughly and were able to make a completely objective choice. We purchased a Burroughs 205 system simply because it supplied the best answer to our needs."* Delivery of the 205 was in May, 1957. The customary step from key-driven machines to punched card equipment was completely bypassed, and the first electronically processed bills were sent out in July

David P. Landry, Supervisor of Electronic Data Processing

Dr. James Ward, Director of Research

of 1957. Regarding their venture into electronic data processing equipment, PP&L's treasurer Don C. Frisbee says, *"At the time we made the jump into electronic data processing there was no established precedent in the utility field. However, with our problems of mounting paperwork, plus our growing needs for solutions to so many engineering problems, we felt it was necessary to make a pioneering move from key-driven equipment directly to an EDP system."*

The customer accounting task for PP&L's 205 was a stickler because their billing problems are so numerous. PP&L's lines extend through Oregon, Washington, Wyoming, Montana and Idaho, and within this large service territory the company maintains 23 districts and 52 offices. Because its territories are so diverse, there are more than 200 different rate schedules. It also reports to five state commissions.

Despite the many complexities, *in one pass* PP&L's 205 computer now processes 30,000 items in one day. And during this same single pass, it bills customers, updates account records maintained on magnetic tape, processes connect and disconnect orders, local bills, adjustments, cash payments and myriad data changes.

Vice-President and Controller of PP&L, George Mackenzie points out, *"The computer didn't solve our paperwork problems overnight. But then we didn't expect it to. We did expect the 205 to enable us to serve our customers faster and more efficiently... and at considerable savings. It has more than met these expectations."* In addition, David P. Landry, Supervisor of Electronic Data Processing at PP&L says, *"Our 205 has not only been fruitful from a tangible dollars and cents point of view, but the computer is also providing new sources of information for management."*

PP&L's 205 has operated on the average of 17 hours per day over the last two years. The company has not been content to restrict its system solely to commercial data processing. PP&L is using its 205 to solve complex engineering problems concerned with the generation, transmission and distribution of power. One of the engineering problems taken over by the machine is scheduling a most efficient use of water stored behind PP&L's three Lewis River Dams to harness the full power potential of the river. The 205 program is, in effect, a mathematical model of the Lewis River hydroelectric facilities. According to Dr. James Ward, Director of Research, *"Its use has saved many hours of tedious calculations. The computer completes in one minute the solution of an operation study which requires 12 to 14 hours when done manually."*

The 205 is also tackling other thorny engineering problems. Routines have been developed for use in planning and designing transmission lines. Another problem involves the calculation of the large short circuit currents which occur when lightning strikes a line. Dr. Ward anticipates that *"the Burroughs 205, in solving technical problems for us, will provide the capabilities of a large scale analog computer, usually used for this work, and costing several hundred thousand dollars."*

In using their 205, PP&L has formed its own operating team. Board Chairman McKee points out, *"Although our data processing equipment team is composed of our own company-experienced personnel, the training they have received from Burroughs has been invaluable in the success of our program. We have found that the backing and service a manufacturer provides is as important as the equipment itself."*

Today, PP&L is working on extending their accounting and engineering uses of the 205 even further. They are confident in their explorations because the 205 has already proven its versatility. And there is assurance too, because all of Burroughs' complete line of advanced data processing systems are designed with customer expansion in mind. These Burroughs computers are currently aiding hundreds of other business and scientific users. For additional information on how the 205 or other Burroughs computing systems can help in your business, write ElectroData Division, Pasadena, California.

Burroughs Corporation *"NEW DIMENSIONS/in electronics and data processing systems"*

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SPEAKING OF SMALL COMPUTERS




lgp-30, g-15, recomp, 1620 placed in line-up

Comparisons are odious, someone has said, but often they are quite interesting and informative as well. DATAMATION intends to present, from time to time, objective comparisons similar to the one appearing on the following pages in the belief that competitive equipment in the computer industry is due for this type of coverage.

Particular inspiration for this piece came from the IBM announcement of their new desk size computer last month. The 1620, it must be admitted, is a neat little machine designed to give its well-established competition fits. Sale priced at $74,500, the computer will rent at a price slightly above two competitors and considerably below a third – $1600 a month.

Incidentally, it was pointed out that one significant precedent has been shattered. This is the first piece of IBM equipment with a monthly rental price lower than the machine's model number.

Along with the side-by-side listings on the next two pages, what can be said of the four machines? We can cite some good and bad features of each. All comments are made on the premise that only four computers are being considered. – LGP-30, G-15, Recomp and the 1620.

LGP-30 – is least expensive of the four machines. There are over 300 now in use and Royal McBee can and is providing fastest delivery. But the 16 command vocabulary is rock bottom and the machine is relatively slow.

G-15 – offers a very attractive extra in expandable input-output (I/O is also fully buffered). The machine has multiple back plugs for black box attachments (allowing easiest access to the computer). However, G-15 machine language coding is anything but a programmer's dream (INTERCOM is recommended) and this computer needs more power and generates more heat than any of the light-weights.

Recomp – is the exclusive owner of built-in floating point. It is also the first small solid state machine. It is physically the smallest of the four and therefore requires less space and is literally portable. But its absolute cost is high. No one questions the machine's merits, but it is still priced high. Also, some programmers are not overly fond of the two instruction per word feature.

The 1620 – boasts the only core memory (true random access storage) of the quartet. It, too, is solid state and seems to be the fastest machine being considered (see ADD TIME on table). The 1620's drawbacks are not immediately obvious. This section of our report will have to wait for the inevitable feedback from users. But one sour note can be sounded now. In light of the fact that this is the newest of the small machines, one can hardly be impressed by the 150 characters/second speed of the 1621 photo-electric reader.

Now we refer you to the line-up on pages 8 and 9.

The IBM 1620

The 1620 consists of two modular units, a Central Processing Unit and a Paper Tape Reader and Punch. No air-conditioning equipment is required.

The 1620 Central Processing Unit contains the operator's control console, a modified electric typewriter, the magnetic core storage unit, the arithmetic and logical unit, and related circuitry.

The keys, lights, switches, and visual displays included on the control console are used for manual machine control, to correct errors, and to display and revise the contents of storage.

The magnetic core storage unit has a capacity of 20,000 alphameric digits, each of which is individually addressable and can be made immediately available for processing. All data introduced into the system is placed in core storage as decimal digits. Alphabetic and special characters are handled automatically, with each being stored as two decimal digits.

The 1620 uses variable field length: only those memory locations required to express a number are used. For example, two positions in memory are required to express the number "twelve," whereas in computers with fixed word length, the same number would require the use of as many as ten positions of memory, eight of which would be zeros to extend the word to its fixed length.

The central processor's arithmetic and logical functions are under control of the computer program. The arithmetical operations of addition, subtraction, and multiplication are accomplished automatically by a table look-up method. Division is performed by an available sub-routine using existing arithmetic operations and logic. A programmer need write one instruction to perform division.

Additions and subtractions of five digit numbers are performed in 560 microseconds. This includes the access time required to make the data available, the arithmetical operation, and the storing of the result in memory. A similar multiplication problem would require 5.96 milliseconds. All internal operations are checked, as is all input-output data.

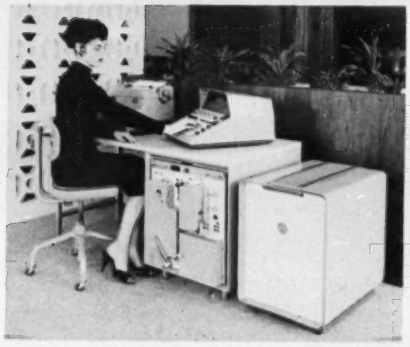
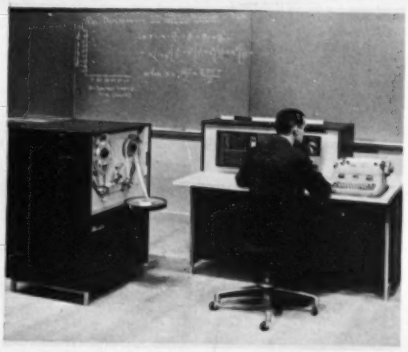
Information is introduced into the 1620 system by means of the 1621 photo-electric paper tape reader and/or the keyboard of a modified electric typewriter. The reader reads eight-channel paper tape at 150 ch/sec. When information is introduced into the system by typewriter, a hard copy record of this data is obtained as a by-product. The 961 tape punch and the typewriter comprise 1620 output devices.

SPEAKING OF SMALL COMPUTERS

ROYAL MC BEE LGP-30

BENDIX G-15

	ROYAL MC BEE LGP-30	BENDIX G-15
MEMORY	4,096 words, drum	2,160 words, drum
MINIMUM RENTAL (month)	$1,100	$1,350
ADD TIME, OPTIMIZED	2.26 ms for single address addition	.54 ms for single address addition
COMMAND VOCABULARY	16 commands	100 commands
ADDRESSING STRUCTURE	single	single
FLOATING POINT	programmed	programmed
BENCHMARK TIME*	41.6 ms	22.1 ms **
CODING SYSTEM	EASE, ACT	POGO, INTERCOM, INTERCARD
INPUT-OUTPUT FACILITY AND TOP I/O SPEEDS	Flexowriter, keypunch card reader 10 digits/second	typewriter, photo-electric tape reader 200 characters/second
WORD STRUCTURE	30 bits + sign	28 bits + sign
ELECTRONICS	113 tubes	450 tubes
POWER	115v, 1500 watts	115v, 3800 watts
OPTIONAL EXTRAS	keypunch card reader photo tape reader fast tape punch	complete card equipment magnetic tapes second paper tape unit DDA device
	Circle 101 on Reader Service Card.	Circle 102 on Reader Service Card.

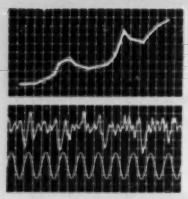
AUTONETICS RECOMP	IBM 1620
	
4,096 words, drum	20,000 digits, core
$3,000	$1,600
.54 ms for single address addition	.80 ms for complete 8-digit add-to-memory ***
49 commands including 9 floating point	32 commands
single	two-address
built-in	programmed
16.2 ms **	20.11 ms
RECEIPE	FORTRAN, assembler
paper tape unit typewriter 400 characters/second	paper tape unit typewriter 150 characters/second
39 bits + sign	character addressable, decimal
transistorized	transistorized
115v, 600 watts	115v, 2000 watts
	none announced****
Circle 103 on Reader Service Card.	Circle 104 on Reader Service Card.

**The benchmark problem chosen for this comparison consists of performing 10 adds and one multiply.*

***These figures are based on optimized coding, using high-speed recirculating storage.*

****The 1620 has no accumulator as such. With true two-address logic, an add command is equivalent to over two single address commands.*

*****One final word—the 1620 will probably not be deliverable for at least a year. While this is not a real drawback (since users will need time to prepare for the machine) it still leaves a clear field to the small computer manufacturer selling to the firm who wants a machine* now.



C-E-I-R HAS PLANS, IS TRAVELING

Ambitious plans and projects seem to be the order of the day for C-E-I-R. In September, "the country's largest independent commercial computing service" announced plans to open five large-scale computer service centers within the next two years. Three of the centers, in New York City, Houston and Washington are scheduled to receive 7090's. A fourth center in Chicago will have "a comparable machine, to be chosen from among the various high-speed computers which will become available from several manufacturers, in 1960." But the fifth center is attracting the most attention. Scheduled to open in Los Angeles by mid-1961, this center will have a "next generation machine" as its heart. (No one will come right out and say STRETCH.) It is not coincidental by any means that C-E-I-R has hired Dr. Herbert R. J. Grosch as Director of Corporate Programs and Planning. Dr. Grosch joined the firm on October 19th and three days later was in Los Angeles where he was interviewed by DATAMATION. Dr. Grosch admitted that he was in L.A. to make preparations for the proposed center. He is currently looking for the nucleus of a staff which will eventually number some 200 people . . . C-E-I-R has also hired Robert R. Joslyn. Joslyn will be manager of the Stockbrokers Service Center to be established in the Washington-Baltimore area. He was formerly manager of Business Applications at the GE Computer Center in Huntsville, Ala.

ANOTHER L.A. STRETCH-LIKE MACHINE?

More L. A. news--It is rumored that The RAND Corp. is seriously studying the possibility of forming a cooperative computer group which will use a machine with STRETCH-like capability. Detailed in the rumor is the fact that RAND is attempting to interest both government and non-government contractors. The competitive atmosphere surrounding the Los Angeles plans being made by both RAND and C-E-I-R will be watched with interest by the entire computer industry.

IBM HAVING NO TROUBLE MOVING 1401

IBM announced its 1401 data processing system on October 5th and then sat back to wait for orders. It wasn't much of a wait. They probably knew that the system would move well but DATAMATION suspects that their estimated total production figure was on the conservative side. Ever-spiralling unofficial reports are being circulated concerning 1401 orders. DATAMATION confirmed one of these reports, to whit: North American Aviation has ordered thirty-one (31) 1401's for its various divisions. It would be safe to conjecture that approximately 1,000 orders for the new business machine have been received to date.

CHANCE VOUGHT, OLIVETTI INCREASE HOLDINGS

The merger parade continues. Chance Vought Aircraft of Dallas acquired a majority interest in National Data Processing Corp., of the same city. This represents a further indication that Chance Vought's diversification is headed toward the computer and data processing industry. It will be remembered that CVA was behind

the formation of Genesys Corp. of Los Angeles. . . . Early in October, Olivetti Corp., of Italy, bought a controlling interest in Underwood Corp. It is common knowledge that Underwood had fallen behind its equivalent numbers in the U.S. business machine field as the latter moved toward developing data processing systems. It would not be at all surprising to see an Olivetti-designed computer marketed by Underwood within a year or two. Initially however, it is believed that the two companies will concentrate on integrating their business machine effort and making their worldwide operation an effective one . . . Bull Machine Co. of France still hasn't picked up a U.S. partner. According to published reports Bull is negotiating with some 12 U.S. companies. Remington Rand still might have a slight edge in this competition.

RCA PLANS FULL TIME CENTER OPERATION

RCA and IBM seem to be engaged in a mild battle of news releases these days. Latest shot -- RCA announced around-the-clock operations are being planned for its Wall Street computer center. That firm will open its financial district facility roughly three months before the doors of IBM's center swing wide. The RCA release stated, "Services offered by the center will include computation of customers' trades, issuance of same-day confirmations with name and address included, and printing of customers' statements, either cycled or end-of-month.

FACTS, FIGURES ANNOUNCED BY REM RAND

Some figures from Remington Rand . . . as of September, seven solid-state systems (both 80 and 90) are rolling off the assembly line every month. This number will be increased considerably by April, 1960. At that time the first solid state tape systems will also be available. RemRand announces a 12 to 15 month wait for systems ordered now. The firm's entry in the random access storage area, Randex, will be available "next spring." The Randex cabinet will contain two drums (minimum unit) capable of storing six million characters. The announced average access time is 400 milliseconds.

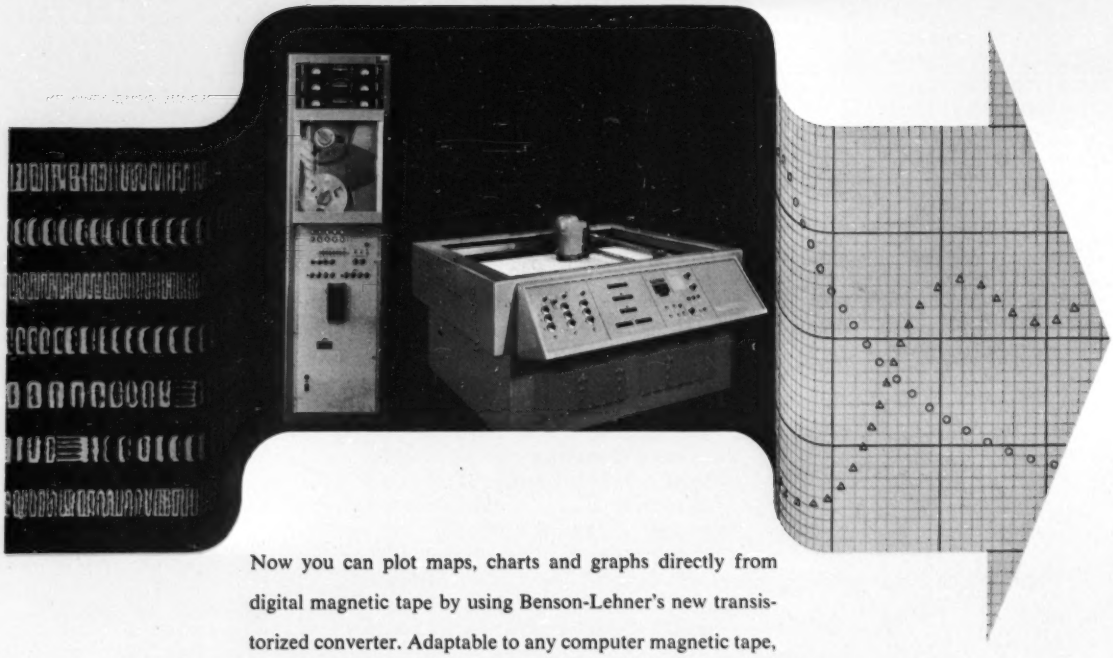
CHANGES NOTED AT COMPUTER SCIENCES

At Computer Sciences Corp., where work on the Honeywell 800 compiler is progressing, some significant personnel changes should be noted. Bob Patrick, one of the firm's founders, left on September 30th to try his hand at consulting. New arrivals include Dave Ferguson, who was formerly chief of programming at the Western Data Processing Center and Dale Hanks, a former North American engineer with varied talents (he is designer of the X-15 fuselage).

A 176-HOUR FOLLOW-THE-LEADER GAME

Minneapolis-Honeywell announced a 176-hour leasing plan for its Honeywell 800. A departure from the industry's 8-hours-daily rental pricing methods, the plan will allow use of a Honeywell 800 system for 176 hours a month on any time schedules required to fill the customer's needs. Honeywell made the move to accommodate firms faced with monthly peak load data processing. It probably was not entirely coincidental that both IBM and Philco announced similar 176-hour plans soon after release by Honeywell hit the streets. It should be only a matter of time before the rest of the industry makes it unanimous.

new! from
benson-lehner...
direct display
from
magnetic tape!



Now you can plot maps, charts and graphs directly from digital magnetic tape by using Benson-Lehner's new transistorized converter. Adaptable to any computer magnetic tape, it eliminates the need for conversion to punched cards and will more than double the speed of the Benson-Lehner ELECTROPLOTTER you already own! By converting digital tape data to an analog voltage, it provides a compatible input for many automatic graph plotters and X-Y recorders. Write now for information or to have an applications engineer help establish your exact requirements.

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steps a

management game for programming supervisors

by

ROBERT BOGUSLAW & WARREN PELTON

A new industry is emerging in the wake of contemporary computer technology – the manufacture of computer programs for large scale automation efforts. This industry consists of firms which have on their payrolls hundreds or thousands of computer programmers, all engaged in the writing of computer programs for large scale, coordinated automation efforts.

Spectacular advances in the design of computers and the development of more sophisticated programming langauges serve to highlight the fact that this is an industry in which production techniques, equipment and skills become obsolete with unprecedented speed. It is an industry where the absence of qualified production managers to supervise the production of these computer programs can lead to unprogrammed and devastating chaos.

STEPS, the STAFF Training Exercise for Programming Supervisors was developed at the System Development Corporation as one effort to do something about providing training for such managers.

STEPS presents a simulated work environment for supervisors or managers of a programming effort. The training goals of STEPS are twofold:

1. To develop competence in recognizing the impact upon work flow of events which can affect production.
2. To develop competence in decision-making programming production.

The most serious difficulty in preparing STEPS had to do with providing a standard unit for describing programs. Programmers talk about the number of orders or instructions which a program contains as indicative of the amount of work which should go into writing it. But this is complicated by questions of "complexity," "difficulty," etc. Before any progress could be made, it was necessary to have some way of describing programs in relative terms; to provide a basis for estimating the time, number, and qualifications of people needed to get them written.

For this purpose a set of seven dimensions or rating scales was developed. These scales are contained in the following table:

TABLE I
PROGRAM RATING SCALES

1. Degree of Generalization
   a. Parameterized, but requires reassembly to change parameters
   b. Parameterized, uses card input for changes
   c. Modularized, uses subroutines and a logical framework (fully parameterized)
   d. Uses executive-subroutine approach, semi-compiler technique
   e. Compiler type, uses a problem language, compiling-machine language
2. Complexity
   a. Simple input-compute-output or service
   b. Straightforward mathematical subroutine
   c. Multi-input, multi-output, straightforward processing
   d. Logically or mathematically complex, independent of other programs
   e. Logically or mathematically complex, system integrated, or simultaneous multi-input output
3. Size
   a. 0-200 instructions
   b. 200-500 instructions
   c. 500-1000 instructions
   d. 1000-4000 instructions
   e. Multiprograms of (d) size or greater than 4000 instructions
4. Level of formulation and planning
   a. Flow-diagrammed – detailed
   b. Formats and detailed functional description documented
   c. Program requirements documented
   d. System analysis complete, system requirements documented
   e. Statement of contract scope and responsibility
5. Dependency
   a. Self-contained, completely independent
   b. Subroutine, meets requirements for use in other programs
   c. Operates as one stage of a 2-4 stage process
   d. Operates within a utility system and as part of a complex program system
   e. Completely dependent on internal system organization and external environment
6. Uniqueness of techniques required
   a. Common, elementary, machine limited by computer language
   b. Common machine language, limited problem oriented language

Robert Boguslaw is Administrator, Staff Training and Warren Pelton is Coordinator for Professional Development with System Development Corporation, Santa Monica, Calif.

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Now both test control and data processing systems are available from one firm – one central source possessing an outstanding record in each area. This is the complete test package needed by today's advanced facilities for rocket and missile power plants – engineered as a single concept by an experienced CSC team. For full information, write for Bulletin 3022-X2.

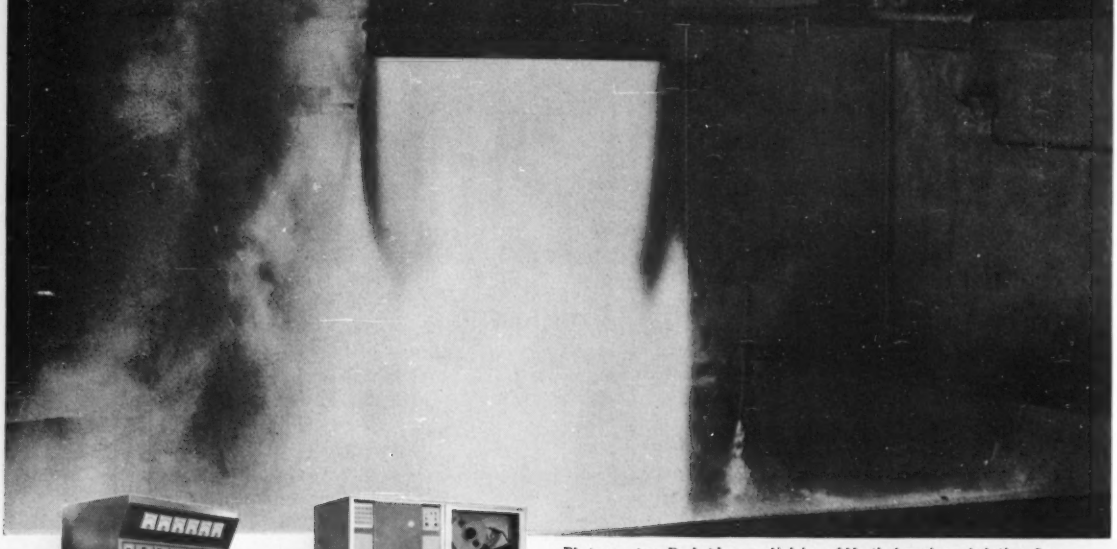
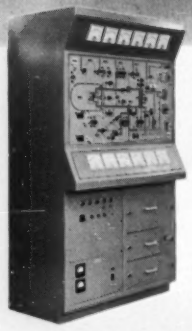
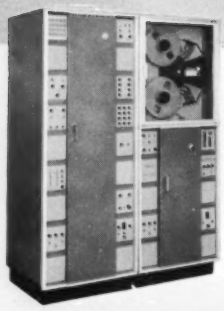


Photo courtesy Rocketdyne, a division of North American Aviation, Inc.





The Consolidated unit shown at far left provides complete programming and control versatility over wide ranges of test conditions.

Right: CSC's new MicroSADIC high speed analog-to-digital data processor which is the heart of an instrumentation system capable of delivering data from transducers to computer.

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c. Computer oriented language and full problem oriented language
d. Universal computer oriented language
e. Advanced developmental language

7. Efficiency requirement
   a. Low (One-shot usage)
   b. Medium (general program usage) no time or space limitations
   c. Medium (general program usage) with time or space restrictions
   d. High (subroutines, utility systems, and highly repetitive programs) no space – time restrictions
   e. High (subroutines, utility systems and highly repetitive programs) with space – time restrictions

work situation for participant

With the use of these rating scales, it was possible to define a programming project without the use of actual programs. This project, in STEPS, is described in a memorandum to the participants and includes a system diagram with verbal descriptions of each program to be produced. These verbal descriptions are designed to approximate the language actually used in talking about programs. They are composed entirely, however, of statements taken from each of the seven scales.

The exercise may be conducted with any number of participants in groups of three. The work situation is identical for each group. Each group represents one "company." The trainees are given desks, chairs, paper, pencils, in-and-out correspondence baskets, and certain work forms.

They are told that they are now employees of the company. Each has the position of section head and all are part of the same project reporting to the project office.

The desks of the three section heads are close to each other so that they may easily confer. All communication with other parts of the environment must be conducted through memoranda or other written forms.

The section head is given an initial work assignment in the form of a memorandum from the project office. This memorandum describes the project tasks, initial responsibilities of Section Heads, money available for salaries, salary and skill levels of all personnel classifications, project office requirements, and project office policy. The section heads are expected to determine the number of employees and personnel classifications needed for initial staffing, to requisition them from the personnel office, and to assign them to appropriate programming tasks. As the exercise proceeds, additional memoranda may be received from the project office, computer room, assistant section head, or other parts of the environment. These memoranda characteristically introduce new difficulties that must be dealt with in the context of the ongoing operation.

Each participant receives information about the progress of his programming effort. He is given the expected date of completion and actual completion date for the current phase of each program. At the completion of each program, a report is received that tells:

1) Number of errors in the program
2) Quality of the program (a summary figure that considers operating efficiency of the program, extent to which program requirements have been met, and the general usability of the program).

In short, each of the three "section heads" is given a verbal description and diagram of the joint project and a statement of his section's responsibilities. No "buck passing" up the chain of command is permitted. Decisions having project wide implications must be concurred in by all section heads.

Monthly budget reports, reflecting the expenditures for salaries, are issued to all participants.

simulated environment

The simulated environment includes persons or offices with which the participants can communicate.

assistant section head and section programming staff

Each section head has a simulated assistant section head. All communication with the simulated section programming staff occurs through the assistant section head. The work accomplished by the staff varies with such factors as personnel categories of the persons involved, duration of assignment, and the specific program and phase of the program on which work is being done.

The assistant section head reports to the section head progress on all programs by the section programming staff.

Work progress is measured by referring to simulation aids. Each phase of each program is given a number representing the "man days of work" required to get it written. The simulation aids show the number of "man days of work" which will be done during any phase as a result of assigning persons of different categories to that phase for a two week period.

The quality and number of errors in a specific program are also determined. It is assumed that for any phase of a program, a minimum skill level for assigned personnel is necessary to ensure standard quality and relative freedom from error. Skill levels in STEPS are represented by six job classifications. If the top job classification of persons assigned to a specific program phase differs from the established minimum, the result may affect quality or number of errors.

project office

The project office represents the immediate superior of the trainees. The strategy here can be varied to suit the requirements of different situations. Additional work requirements are not assigned directly to sections. The project office informs all sections of a new requirement and indicates that any reasonable method, concurred in by all section heads, will be approved. A diary of unanticipated events, contains a listing of emergency situations which may arise. These events, inserted in a planned sequence, complicate the programming supervisor's planning task and provide realistic challenges to the participants.

(Continued on next page)

other offices

All changes of personnel status are processed through the personnel office. Recruiting of new personnel is accomplished by referring to hiring and termination probabilities, which specify both the probabilities of hiring different categories of personnel in various time periods and termination probabilities for each category. Hiring new personnel and terminating old personnel is accomplished through the use of predetermined hiring and terminating probabilities.

Transfers from one section to another are processed through the personnel and finance office to ensure appropriate accountability of funds.

Monthly reports reflecting the expenditures of each section and the remaining funds in the project budget are distributed by the finance office.

Simulation of the computer room is confined to notification of all section heads by memoranda when the computer becomes nonoperational or unavailable. These memoranda are prepared before the exercise by utilizing a table or random numbers. The memoranda are part of the diary of unanticipated events.

Participants who require additional forms, pencils, paper, etc., may obtain them by writing notes to the supply room. The supply room complies with all requests on a reasonable realtime basis.

knowledge of results

At the conclusion of a STEPS session the trainees are presented with information about the results of their performance. This information is prepared by the simulators and includes the following:

1) **Speed with which contract commitments were fulfilled.**
   A Program Progress Report is completed to reflect the date of completion of each program and program phase.

2) **Economy of Operations.**
   A completed Salary Budget Status form shows the amount of money spent by each section for salaries each month. It also shows total salary expenditure by section and company for entire project.

3) **Numbers of Errors in completed programs.**
   A Program Quality Data Chart provides a phase-by-phase account of the occurrence of errors. These are determined by the personnel assignments made by the trainees.

4) **Quality of work produced.**
   This is available as a summary figure which reflects the following:
   a) Operating efficiency of program
   b) Extent to which program requirements have been satisfied
   c) General usability of the program
   The program quality data form provides a phase-by-phase account of the occurrence of increments to standard quality. This, too, is determined by personnel assignments made by participants.

With the aid of this information it is possible for trainees to review the extent to which they succeeded in recognizing the impact work flow of various events which occurred during the exercises and assess the effectiveness of their decisions in getting programs produced.

environment modification

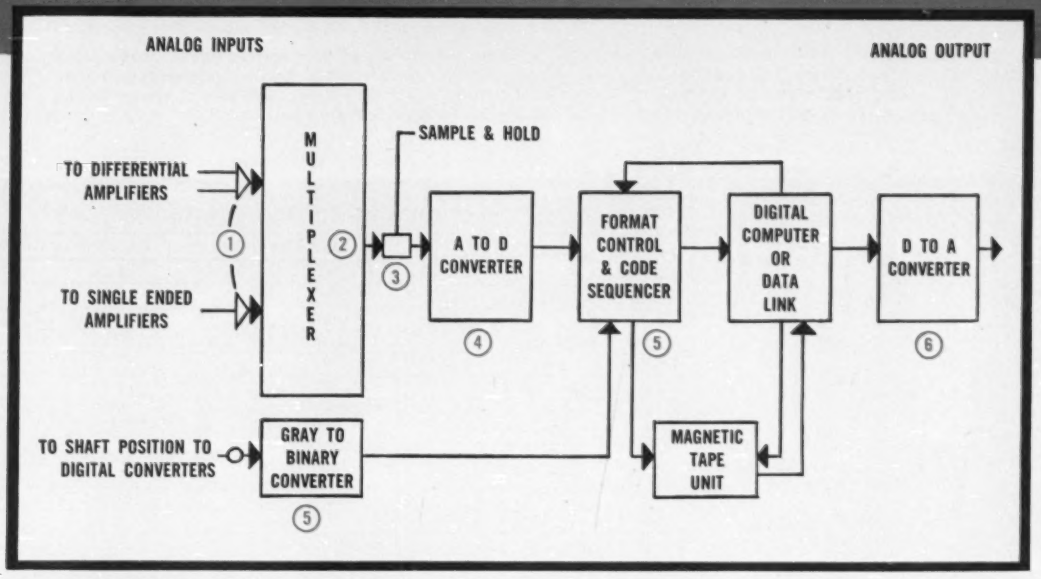
The simulated environment is not, of course, an accurate replica of the environment encountered by an actual programming supervisor. Many features of typical live environments have been modified or ommitted.

The hiring and termination rates are approximations. Also, live subordinates are not used; instead, estimates of the amount and quality of work that would be done by such personnel are utilized. For such estimates to be accurate, they should be based upon actual work records for similar programming tasks. The seven scales provide a basis for comparing the performances of different employees. Probabilities of work progress, errors, and quality of completed programs are assigned on the basis of standard performance for actual personnel with analogous classifications. This standard, however, can be only approximate since actual work records have never previously been maintained in terms of our scale categories. Moreover, differences between individuals of the same grade have been omitted except for one feature: individuals assigned to programs classified as "similar" (to programs on which they have previously worked) require less time to become productive than individuals transferred to programs classified as "different" (from programs on which they have previously worked).

A substantial portion of the time of a programming supervisor would normally be devoted to dealing with the human part of his environment through such activities as telephone conversations and face-to-face meetings with staff subordinates, supervisors and peers. The only part of this environment thus far included within STEPS is the face-to-face meetings of a participant with the other section heads on his project. We have given considerable attention to the possibility of enriching the simulation by including in the Diary of Unanticipated Events requirements or options for participants to engage in face-to-face meetings and telephone conversations with subordinates and superiors. Results of such meetings could readily be translated into operationally significant records when appropriate.

This, then, is another of the methodological developments which we find so exciting – the utilization of outcomes of interpersonal encounters as inputs to the production process. Although considerable work remains to be done, we feel that it will be possible to provide effective well balanced training for programming production managers who, in the computer program manufacturing industry must deal not only with the hard facts of complex computer programs, but with what, on occasion, must seem to be the equally hard heads of programming people as well.

COMPATIBLE COMPONENTS
for Data Processing Systems



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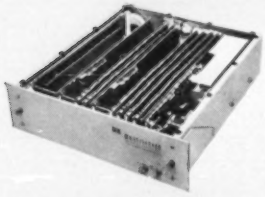
1. REDCOR DC AMPLIFIERS

A new line of 200 KC, low noise, solid state dc instrumentation amplifiers with transistor chopper stabilization. Differential models provide 100 meg-ohms input impedance and 120 db common mode rejection. Redcor Potentiometric and Operational Amplifiers also provide eye-opening performance.



2. COMMUTATORS AND MULTIPLEXERS

High speed solid state commutators permit one MULTIVERTER to do the work of many A-to-D converters. Where random switching to one of many analog channels is required, PBCC Multiplexers offer high performance and economy.

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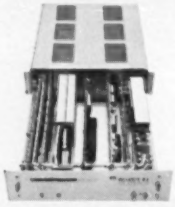
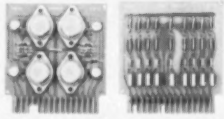
Varying voltages fed to the "Sample and Hold" unit may be individually or simultaneously sampled and then held to provide time coincident data for computing. As are all Packard Bell Computer products, the Sample and Hold is solid state throughout.



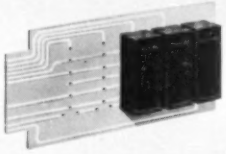
4. ANALOG TO DIGITAL CONVERTERS

The highly versatile MULTIVERTER series affords reliable solid state A-to-D conversion accurate to 0.01% at 4 microseconds per bit. Its advanced solid state design has already become an industry standard and is thoroughly field proven.



5. DIGITAL MODULES

Low cost, reliable solid state transistorized and magnetic digital modules are available for rapid construction of special systems. 200 KC and 3 MC transistor modules, 50 KC and 100 KC magnetic modules and a self-powered case available from stock.



6. DIGITAL TO ANALOG CONVERTERS

Among many available D-to-A converters is a new unit with analog storage called Magnahold. It permits a single time-shared D-to-A converter to handle a large number of conversion channels. The new 2 oz. plug-in, Digit-AC converts digital data to AC voltage and is specially designed for airborne applications.

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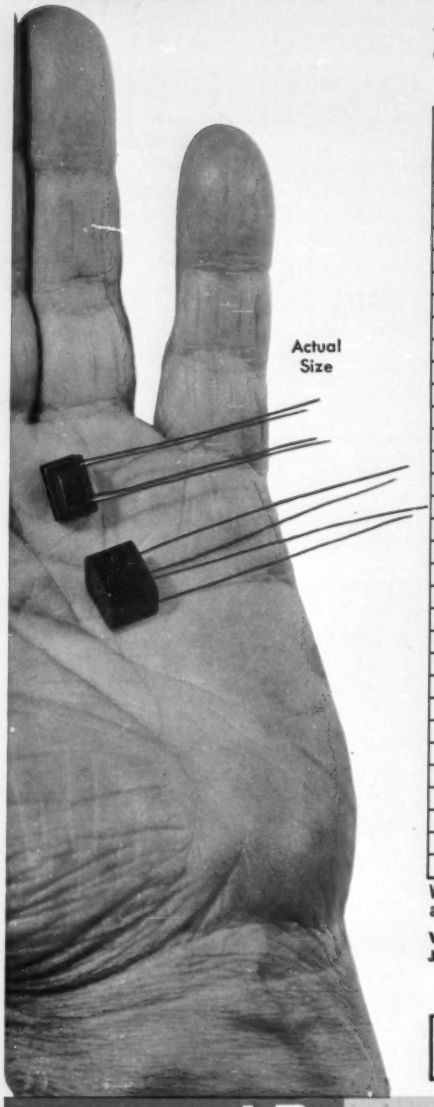

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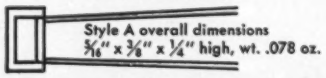
PART NO.	APPLICATION	TURNS RATIO PRI. TO SEC.	IMPEDANCE (OHMS)		D.C. RESISTANCE (OHMS)	
			PRI.	SEC.	PRI.	SEC.
JB1	INTERSTAGE	4.47:1	20,000	1,000	1,700	275
JB2	INTERSTAGE	5.01:1	20,000	800	1,600	170
JB3	INTERSTAGE	2.56:1	10,000 CT	1,500 CT	1,150	110
JB4	OUTPUT	2.83:1	500	50	115	12
JB5	OUTPUT	2.82:1	400	50	70	10
JB6	INPUT	14.1:1	200,000	1,000	6,500	245
JB7	OUTPUT	4.00:1	1,000	50	240	16
JB8	INPUT	14.0:1	200,000 CT	1,000 CT	6,500	245
JB9	OUTPUT	1.54:1	1,500 CT	600	210	120
JB10	REACTOR		3 HYS. @ 2ma		1,100	
JB11	REACTOR		1 HY. @ 2ma		200	
JB12	REACTOR		6 HYS. @ 2ma		2,600	
JB13	OUTPUT	13.5:1	600	3.2	90	0.8
JB14	OUTPUT	18.0:1	1,200	3.2	190	0.8
JB15	OUTPUT	53.2:1	10,000	3.2	1,500	0.8
JB16	DRIVER	4.44:1	10,000 CT	500 CT	1,160	45
JB17	DRIVER	3.03:1	10,000	1,200 CT	1,160	100
JB18	DRIVER	2.22:1	10,000	2,000 CT	1,380	170
JB19	OUTPUT	1.23:1	900 CT	600	105	110
JB20	OUTPUT	1:1.10	500 CT	600	60	105
JB21	OUTPUT	1:1.42	300 CT	600	40	110
JB22	OUTPUT	3.30:1	150 CT	12	25	3
JB23	OUTPUT	4.85:1	300 CT	12	40	2
JB24	OUTPUT	6.98:1	600 CT	12	85	2
JB25	OUTPUT	8.14:1	800 CT	12	100	2
JB26	OUTPUT	9.07:1	1,000 CT	12	150	2
JB27	OUTPUT	10.0:1	1,500 CT	12	230	2
JB28	OUTPUT	25.0:1	7,500 CT	12	750	2
JB29	INTERSTAGE	5.00:1	20,000 CT	800 CT	1,500	160
JB30	REACTOR		12 HYS. @ Oma		2,000	
JB31	REACTOR		20 HYS. @ Oma		2,800	
JB32	INTERSTAGE	1:3.00	10,000	90,000	980	5,600

Windings of above units are from wire size 34 A.W.G. to 52 A.W.G.—wound on nylon bobbins and using nickel alloy laminations. Leads are #26 A.W.G. solid tinned copper wire 2" long.

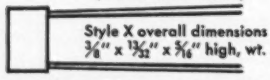
WHEN ORDERING, specify style desired by suffixing **-A** or **-X** to part number. (i.e. **JB1-A, JB32-X,** etc.)

STYLE A
(Core and Coil only)



Style A overall dimensions
5/16" x 3/8" x 1/4" high, wt. .078 oz.

STYLE X
(Black Phenolic Case)



Style X overall dimensions
3/4" x 13/32" x 5/16" high, wt. .099 oz.

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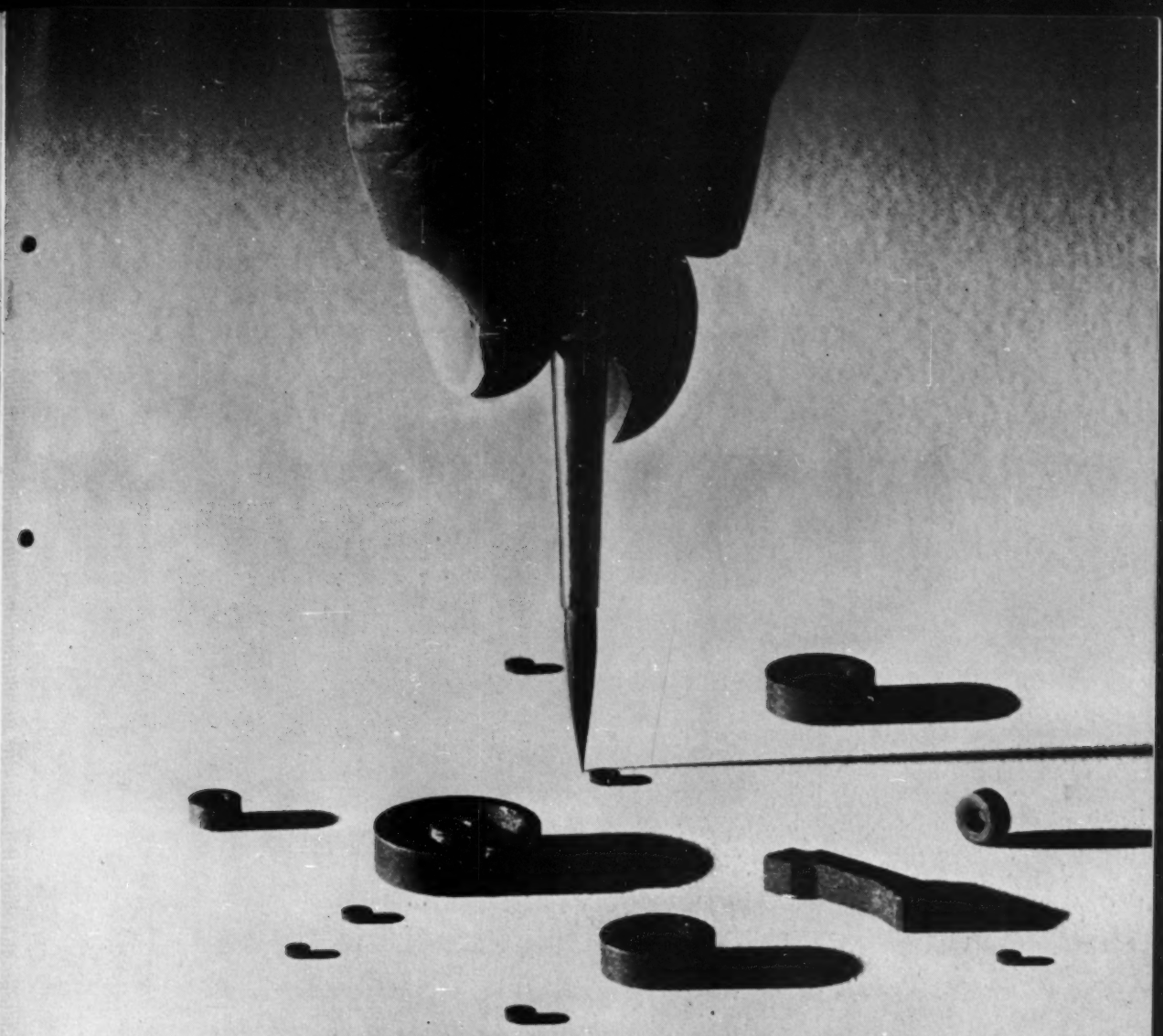

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LOCKHEED ELECTRONICS & AVIONICS DIVISION

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✱ Selected data, either tabular or graphic, may be projected on an accessory direct-view screen only 8 seconds after film exposure.

At the David Taylor Model Basin, the S-C 4020 is used in the applied mathematics laboratory for the solution of various Naval problems, including ship design, hydrodynamics, structural mechanics and nuclear reactor design. It is ideal for all kinds of high-speed graph plotting, computer printing, filing and archive storage.

Printers similar to the one in use by the U. S. Navy are coming off the production line right now. The S-C 4020 does not represent a proposed future design. It is available and working. You can have your own printer saving you hundreds of valuable man hours within six months time. Write for Bulletin D-12. Stromberg-Carlson-San Diego, 1895 Hancock Street, San Diego 12, California.

SEE THE STROMBERG-CARLSON-SAN DIEGO EXHIBIT AT THE 1959 EASTERN JOINT COMPUTER CONFERENCE. BOOTHS 10 AND 11.

STROMBERG-CARLSON - SAN DIEGO
A DIVISION OF **GENERAL DYNAMICS CORPORATION**

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HERE COMES THE 1604

control data offers new solid state machine

New machines, and new companies to produce them, are always welcome additions to the computer industry . . . at least as far as users are concerned. With this article, DATAMATION takes official note of Control Data Corporation of Minneapolis and their 1604 computer.

Model 1604 is a transistorized, stored program, general-purpose digital computer. Control Data says it is offering the 1604 at a lower price than comparable computers. Following is a brief summary of 1604 features:

- completely solid state
- 32,768 48-bit words of magnetic core storage
- parallel mode of operation
- single address logic, 2 instructions per 48-bit word
- 6 index registers
- indirect addressing
- program interrupt
- versatile input-output facilities
- small size (goes in 20′ x 20′ room)

In addition to communicating with standard peripheral equipment, such as magnetic tape units, card readers, punches, and typewriter, the 1604 can also be used for control or communication in radar and sonar systems, real-time instrumentation systems, high-speed digital communication systems, and special display systems.

In the 1604 computer, input-ouput operations are carried out independently of the main computer program. When transmission of data is required, the main computer program is used only to initiate an automatic cycle which buffers data to and from the computer memory. The main computer program then continues while buffering of data is carried out independently and automatically.

The input-output section of the 1604 contains the facility for several modes of communication. For normal exchange of data with peripheral equipment, independent control is provided for the transfer of data via three 48-bit buffer input and three 48-bit output channels asynchronously with the main computer program. For high-speed communication one 48-bit input transfer channel and one 48-bit output transfer channel are provided so that two or more 1604's can communicate. Communication control is performed by the external function instruction. In addition, the interrupt feature provides requests from peripheral equipment to the computer.

The storage section of the 1604 is a large-capacity magnetic core storage system providing high-speed, non-volatile, random-access storage for 32,768 48-bit words. One 48-bit word may contain either a 48-bit data word or two 24-bit instructions. The read access time, i.e., the time from request of data to delivery of data from storage, is 2.2 microseconds.

The core storage section of the 1604 is controlled by a two-phase timing system, each phase controlling one half of the total storage. All odd storage addresses reference one storage unit, and all even addresses reference the other storage unit. The read access time of each section is 2.2 microseconds after which, without delay, the next

arithmetic operation is initiated. Each unit has a total storage cycle time of 6.4 microseconds. The storage cycles of the two sections overlap one another in the execution of a program with the result that the effective cycle time is 3.2 microseconds when addresses of alternate memory banks are referenced. The average effective cycle time for random addresses is about 4.8 microseconds for a representative program.

The 1604 instruction repertoire contains a flexible list of 62 instructions which expand into many sub-instructions. These 62 instructions provide fixed binary point arithmetic (integer and fractional), floating binary point arithmetic, logical and masking operations, normal arithmetic operations modulus 2^{48} minus one (one's complement), indexing, memory searching, input-ouput, sequence control (conditional and unconditional), multiple precision capability, etc. Programming features include handling constants, indirect addressing, four search instructions, high-speed input-ouput transfers, buffering, external function, program interrupt, and a group of logical commands.

In addition to the standard 1604 console with its display panel (translated contents of all operational registers are displayed in Arabic numerals – octal), typewriter, and paper tape reader and punch, Control Data offers as optional equipment the Model 1607 Magnetic Tape System and the Model 1605 Adaptor. A number of 1607 Magnetic Tape Systems can be attached to a 1604 Computer. Simultaneously among these 1607's, three tape handlers can be reading and three can be writing – each at a 30KC character transfer rate. Each 1607 tape system has the facility for simultaneously reading from one tape handler and writing on one tape handler, while the remaining two tape handlers are rewinding.

The Control Data Model 1605 Adaptor permits communication between the 1604 Computer and any of the following IBM peripheral equipment: 714 Card Reader, 727 Magnetic Tape Units, 717 Line Printer, and 722 Card Punch. ●

Circle 105 on Reader Service Card.

IFIPS STATUTES TO BE CONSIDERED

member societies must ratify by january 1, '60

On this page, DATAMATION readers will find the Statutes of the International Federation of Information Processing Societies. These statutes will become effective on January 1, 1960 subject to conditions contained in the final item listed. Initial membership includes societies from Canada, Czechoslovakia, Denmark, Finland, France, Germany, Japan, Mexico, Netherlands, Poland, Spain, Sweden, United Kingdom, U.S.A. (National Joint Computer Committee), and the U.S.S.R.

NAME AND AIMS

1. An International Federation of Information Processing Societies shall be constituted in order to achieve the following basic aims:
   a) Sponsor international conferences and symposia on information processing, including mathematical and engineering aspects.
   b) Establish international committees to undertake special tasks falling within the spheres of action of the member societies.
   c) Advance the interests of member societies in international cooperation in the field of information processing.

SEAT AND LEGAL PERSONALITY

2. The seat of the Federation shall be in Brussels, Belgium. The Federation shall be registered in compliance with the Belgian Law of 25 October 1919, concerning international scientific societies with no lucrative aims, completed by the Law of 6 December 1954.

MEMBERSHIP

3. A national technical or scientific society or a group of such societies of any country may become a member of the Federation subject to their admission by the Council of the Federation. Such decisions require a majority of all the members of the Council.

4. Membership may be terminated (a) by a vote of the Council if a member is one year in arrears in payment of its subscription, or (b) by a declaration of a member organization that it wishes to terminate its membership.

OPERATION

5. The Federation shall be directed by a Council composed of one representative only from each of the National Societies concerned. If there are two or more members in any one country, these members shall be represented in the Council by one person only with one vote.

6. The Council shall determine the general policy of the Federation. It shall adopt its programme and budget, hear the reports of any subordinate organs it may have established, and review expenditure.

7. The Council may establish such subordinate organs as may be necessary for permanent or temporary purposes. The composition, the terms of reference and the duration of such organs shall be determined by the Council by a majority of all its members.

8. The Council may appoint an Executive Secretary. The assignments and the duration of the functions of this person shall be determined by the Council. The Executive Secretary shall be empowered to employ additional staff as directed by the Council.

9. The Council may take any other decision necessary for the implementation of the programme of the Federation. In particular it may decide to secure the collaboration, on a contractural or "ad hoc" basis, of other international organizations, national institutions or laboratories, in order to carry out certain tasks.

10. The Council shall elect from among its members a Chairman in the odd years and Vice Chairman in the even years. These officers shall remain in office for two (2) years and may be re-elected for one additional term of office. They will remain in office until their successor is elected. If an officer should resign or die in office the Council shall elect a successor for the unexpired year.

11. The Chairman shall preside over the discussions of the Council, approve the draft minutes of the discussions, and convene the next meeting of the Council. The Vice Chairman shall, during the absence or incapacity of the Chairman, act in his stead on all matters concerning the Council.

12. The Council shall decide itself upon the dates and place of its sessions. However, it may be convened at any time if the Chairman, after consultation with the various organs or persons appointed by the Council, deems it necessary, and it shall be convened within three months upon the request of a majority of its members.

13. The Council shall be able to conduct business if half of its members are present or represented by proxy. A decision of the Council shall be taken by a simple majority of the members present and represented except where otherwise provided in these statutes.

If a quorum is not present, the Council may conduct its business provided its actions are ratified by mail by two-thirds of the Council members. Council business may be transacted on the initiative of the Chairman or Executive Secretary by mail with the affirmative vote of two-thirds of its members.

FINANCES

14. The Federation shall be financed by contributions from its members. The amounts of these contributions shall be voluntary but the minimum annual amount shall be 250 U.S. Dollars.

15. The Council of the Federation may accept subventions and donations.

AMENDMENTS

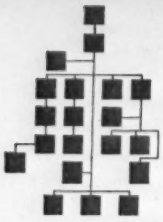
16. These statutes may be amended by the Council. Amendments shall require a two-thirds majority of all the Council members.

DISSOLUTION

17. The Federation shall be dissolved if the Council so decides by a two-thirds majority of all its members.

ENTRY INTO FORCE

18. These statutes shall enter into force on January 1, 1960, provided however that they have been ratified by at least 7 of the National professional Societies or groups of Societies (from countries listed in the preface) to these statutes. The ratification shall be deposited with the Chairman of the provisional Bureau.



people moving up in DATAMATION

John Jipp, Ampex Instrumentation Div.'s manager since '57, has become a vp of the corporation. . . . IBM's San Jose Lab., announced the promotion of **Dr. Byron J. Bennett** to senior engineer. **Dr. Albert S. Hoagland** has been named manager of engineering sciences research; **Dr. Arthur G. Anderson,** manager of the physical science research; **Dr. Gardiner L. Tucker,** resident manager of the research lab. . . . **Berne N. Fisher,** general manager of Brubaker Electronics div., of Telecomputing Corp., has been advanced to vp of the parent corporation.

Thomas A. Kirkland has been appointed executive asst. to Jay W. Schnackel, vp and general manager of RemRand Univac. Formerly a vp of IBM's World Trade Corp., Kirkland will assist in marketing liaison between the Univac and the International divs. . . . **John M. Evans** joined Packard-Bell Electronics as manager of special products manufacturing in the Technical Products Div. . . . Raytheon has appointed **Henry F. Schunk** head of the Lewiston semiconductor plant to prepare the administrative and training group . . . Election of **Henry Lehne** as senior vp was announced by Sylvania Electric Products, Inc. His duties will be over-all responsibility for the Electronic Systems div.

JOHN JIPP
Vice Pres., Ampex Corp.

T. A. KIRKLAND
Executive Assistant, RemRand

E. R. GAMSON
Vice Pres., Telemeter Magnetics

MORRIS PLOTKIN
Chief of Analysis, Auerbach

M. L. LESSER
Research Staff Manager, IBM

H. I. CHAMBERS
Assoc. Dir., DataTape Div. CEC

Telemeter Magnetics has elected **Edwin R. Gamson** – the general manager of the component div. – to vp of the company . . . **Robert L. Yeager** has been appointed to the newly created post of general sales manager of Standard Products, Electronic Associates, Inc. . . . Epsco, Inc., in planning company growth objectives for the future, added key men to their staff during the past six months. Some of them are: **Eugene S. Goebel,** vp marketing of all divs; **Harry H. Rosen** (vp) general manager of new Philadelphia subsidiary, Monitor Systems, Inc; **Leighton Meeks,** senior engineering manager; **Werner Fleig** and **Dr. Philip Amlinger,** chief engineers; **James Doyle,** senior engineer; **Howard Carter, Sr., Russell Quackenbush, Sr.,** and **Winston Walker, Sr.,** project managers . . . Marc Shiowitz & Assoc., announced the appointment, as full time staff member, of **Kenneth O. King,** consulting engineer in logical and circuit design fields of computers.

Morris Plotkin has been appointed chief of analysis at Auerbach Electronics. Plotkin is nationally known for his work in mathematical and system analysis and system design. He originated or developed some of the basic techniques now standard practice in the operation of analog computers. **Joseph Wylen,** ex-Burroughs, was named manager of equipment development . . . The American Thread Co., advanced **James J. Zervos** to newly created post of coordination manager for data processing, and **Henry T. Reid** to tab dept. supervisor . . . National Bureau of Standards' Applied Mathematics div., engaged **George W. Reitwiesner.** He was formerly chief of computing methods section, Ballistic Research Labs., at Aberdeen Proving Grounds . . . **Robert G. Parks,** specialist in computer systems, ex Burroughs ElectroData, has been appointed senior project engineer of Neff Instrument Corp., Pasadena.

Murray L. Lesser is the new manager of the Research Technical Staff, IBM, Yorktown. He joined the firm in '54, was a staff engineer in '56: advisory and then senior engineer in '57. **Robert E. McMahon,** joined Transistor Applications, Inc., as a vp and chief engineer. McMahon was formerly a staff member at M.I.T.'s Lincoln Lab. and pioneered in early transistor switching circuits; developed the memory section of the CG-24 transistorized computer . . . Burroughs' ElectroData div., appointed **Gordon Lovelace** their Boston district manager.

Herbert I. Chambers has been named associate director of the DataTape Div., Consolidated Electrodynamics Corporation. **Fred F. Grant** is now manager of the engineering dept., and **Edgar E. Hotchkin** is manager of the magnetic head section at CEC. Other appointments: **Joseph E. Jenkins,** marketing manager for DataTape products; **Dr. John G. Frayne,** manager of development engineering at Datalab . . . Stromberg-Carlson's Special Products div., announced creation of two managerial positions: **Edward R. O'Hara,** manager of manufacturing; **Mark E. Woodworth,** manager product planning, market research.

Important dates in DATAMATION

Dec. 1-3: Eastern Joint Computer Conference, Statler Hotel, Boston. Sponsored by ACM, IRE and AIEE. Contact J. H. Felker, Chairman Program Committee, Bell Telephone Laboratories, Room 5C-101 Mountain Ave., Murray Hill, N.J.

Dec. 1-2: Fourth Midwest Symposium on Circuit Theory, Brooks Memorial Union, Marquette University, Milwaukee, Wisc. Sponsored by PGCT and Marquette University. Contact James D. Graham, College of Engineering, Marquette University, 1515 W. Wisconsin Ave., Milwaukee 3, Wisc.

Dec. 6-9: 52nd Annual Meeting of the American Institute of Chemical Engineers, San Francisco, Calif. Contact Professor T. Vermuellen, Dept. of Chemical Engineering, University of California, Berkeley, Calif.

1960

Jan. 27-29: American Mathematical Society Meeting (66th Annual), Conrad Hilton Hotel, Chicago, Ill.

Jan. 31-Feb 5: AIEE Computing Devices Committee 1960 Winter General Meeting, New York City. Contact G. L. Hollander, Chairman, c/o Philco Corp., 4700 Wissahickon Ave., Philadelphia 44, Penna.

Feb. 3-5: 1960 Winter Convention On Military Electronics, Ambassador Hotel, Los Angeles, Calif. Sponsored by IRE Professional Group on Military Electronics. Contact Gordon B. Knoob, Motorola, Inc., Military Electronics Div., 1741 Ivar Ave., Hollywod 28, Calif.

Feb. 10-12: Solid State Circuits Conference, University of Pennsylvania, Philadelphia, Pa. Sponsored by PGCT; AIEE; Univ. of Penna. Contact Tudor R. Finch, Bell Telephone Labs., Murray Hill, N.J.

Feb. 15-19: SHARE XIV Meeting, Statler Hilton Hotel, Los Angeles, Calif. Contact Jerry Koory, System Development Corp., Santa Monica, Calif.

Mar. 21-24: IRE National Convention, Coliseum and Waldorf-Astoria Hotel, New York City.

Apr. 20-22: Texas Symposium on Instrumentation, Texas A&M College Campus, Bryan, Texas. Contact Dr. N. E. Welch, Symposium Director, Texas A&M College, College Station, Texas.

Apr. 20-22: Southwest IRE Regional Conference and Electronics Show, Shamrock-Hilton Hotel, Houston, Texas.

May 2-6: Western Joint Computer Conference, San Francisco, Calif. Sponsored by PGEC; AIEE; ACM. Contact H. M. Zeidler, Technical Program Chairman, Stanford Research Institute, Menlo Park, Calif.

May 10-12: 1960 Electronic Components Conference, Washington, D.C. Sponsored by IRE, AIEE, EIA and WEMA. Contact Gilbert B. Devey, Technical Program Chairman, Sprague Electric Co., North Adams, Mass.

May 15-18: IASA 38th Annual Conference and Business Show, The Sherman, Chicago, Illinois. Sponsored by the Insurance Accounting and Statistical Association.

Aug. 23-25: ACM National Conference, Marquette University, Milwaukee, Wis.

Aug. 29-Sept. 3: American Mathematical Society Meeting, Michigan State University, East Lansing, Michigan.

September: National Symposium on Telemetering, Washington, D.C.

Sept. 12-16: SHARE XV Meeting, Pittsburgh Hilton Hotel, Pittsburgh, Penna. Contact E. B. Weinberger, Gulf Research & Development Co., P.O. Drawer 2038, Pittsburgh 30, Penna.

Oct. 19-26: Second Interkama – International Congress and Exhibition for Measuring Techniques and Automation.

December: Eastern Joint Computer Conference, New Yorker Hotel, New York City. Sponsored by PGEC, AIEE, ACM.

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B/A DEKATRON TUBES—Full line of 7 types
High speed (up to 20,000 cps)
— Reliable up to 75,000 hours
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B/A MINIATURE DIGITRON GR 10W
10 digit direct readout
— simple — compact — long life
— suitable for miniature remote readout systems.

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Direct readout — ¼, ½, ¾,
May be used to display the state of count of a ring of 4 cold-cathode or thermionic tubes.

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May be applied to register the arithmetical operation being followed during random add-subtract counting operations.

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Ideal for use in a remote readout or indicator panel.

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No jumps in characteristic
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Designed for use in Dekatron coupling and readout circuits
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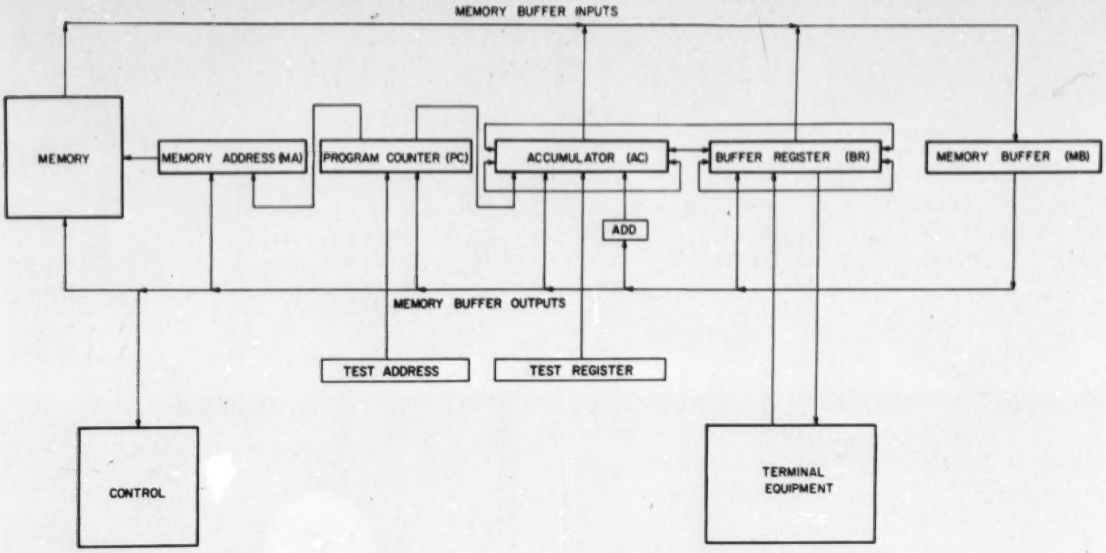

SPECIAL PURPOSE PDP HAS GP APPLICATIONS

digital equipment's computer is expandable

The Programmed Data Processor (PDP) is a high-speed digital computer designed to be a building block of a wide class of special systems. PDP is also a general purpose computer which can be used as a computational facility. Digital Equipment Corporation of Maynard, Mass., will exhibit a model of PDP at the Eastern Joint Computer Conference.

The PDP computation rate, including two calls on memory, is 100,000 additions per second (approximately 2.5 times the speed of large computers in use today and 100 times the speed of magnetic drum computers). Multiplication and division are available as built-in instructions or as a subroutine augmented by special iteration step instructions. The multiplication rate is 40,000 per second for a 36-bit PDP having built-in multiply.

The computer is available in word lengths of 18, 24, 30, and 36 bits. The 5 microsecond, coincident current magnetic core memory is modular in units of 1024 or 4096 registers. The input-output section of the machine is designed for maximum flexibility.

Additional external equipment, such as analog conversion devices, may be added with no internal machine changes. Thirty-one registers of the main memory are used as automatic index registers. Multiple step deferred (or indirect) addressing is a standard feature.

One application being planned for PDP is dynamic simulation of a weapons system using it as the central computer in combination with analog computers. Iterative computations for some parts of the simulation will be completed as often as once every millisecond. Multiplexing of 20 input and 20 output analog channels will be used in this application.

This type machine is applicable in bio-electrical signal analysis, where digital filtering and statistical analysis are needed due to a signal-to-noise ratio of less than one.

The large cathode ray tube display is an available output when PDP is used for control and simulation. When used with photo-electric sensing devices, the display becomes an input source. Magnetic tape units, line printers and special buffers are available.

PDP is built of Digital's standard line of building blocks. Preventive maintenance through use of marginal checking is included. No special installation, such as subflooring, is required. Single-phase power needed is 110 volt, 60 cycle.

"PDP makes the advantages of high-speed computation available in situations where economic considerations could only justify serial drum-type machines," a DEC spokesman stated. ●

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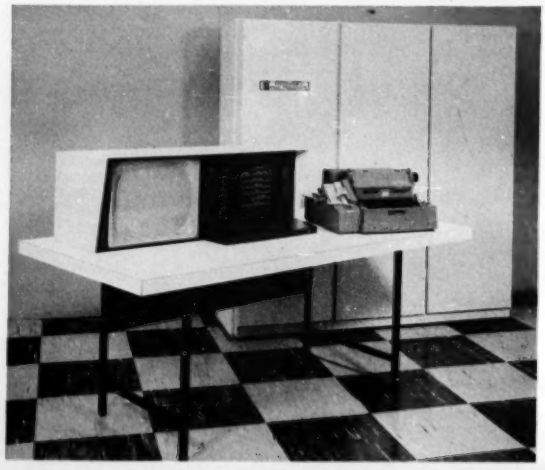
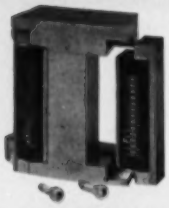
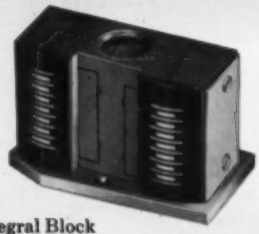




"Gap-Mounted."*



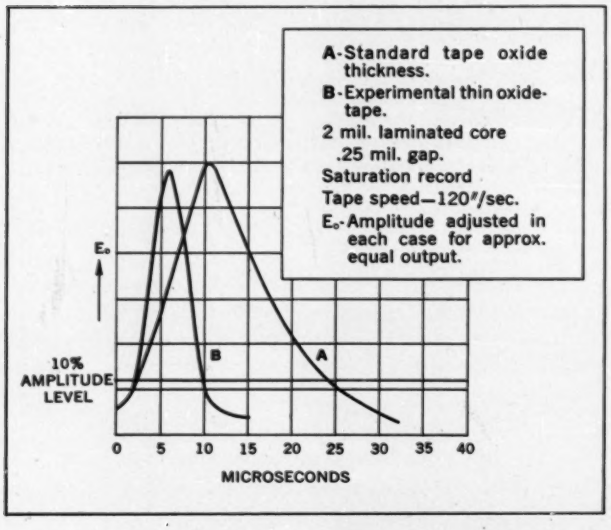
Integral Block Interlace.

CLEVITE 'BRUSH'

Magnetic Heads for Digital Recording

Get more capacity...reliability...faster access ...whether you're designing a new pulse system...or modernizing your present one.

Why settle for less than the best magnetic head —the "heart" of your digital recording system? Whether your digital recorder is in the design stage, on order or in use now, Clevite "Brush" magnetic head specialists can improve your system at low cost. Write for prompt quotations on replacement or "modernization" heads for any existing transport, or specials including flux-responsive or high resolution heads. Write for Clevite Digital Recording Bulletin for complete information.



Pulse width comparison—standard and thin oxide tape.

CAPACITY— Five series of Clevite "Brush" multichannel heads give channel format variety for standard tape widths from ¼" to 2". A single block will handle up to 16 channels per inch of media width—an interlaced block up to 32 per inch. Clevite heads read pulse widths down to 1½ mils recorded to saturation on 0.3 mil coating instrumentation tape—approximately 600 pulses per inch with self-erasing saturation recording. More than 300 ppi packing is possible on 1 mil coated drums, operating 0.2 mils out of contact with a 3 mil pulse width on the drum.

ACCESS— Careful choice of material plus unique design and construction techniques enable Clevite "Brush" heads to provide uniform performance at very high processing rates. The heads themselves respond to wave lengths down to .15 mils (1.5 MC at 240 IPS) but standard instrumentation tapes and transports usually reduce the practical repetition rate of saturated recording to approximately 30 KC and 15 KC for RTZ and NRTZ respectively.

RELIABILITY— Clevite "Brush" tape and drum heads hold track width and location to ± 0.001-inch tolerance. Azimuth, contact angle and gap perpendicularity are true ± 0 deg., 5 min. and can be held even closer when required. "Gap-mounted" head (see photo) has lapped bracket and cartridge surfaces for fast replacement without critical adjustment. Redundant and interlaced (see photo) designs provide immediate checking of recorded data and higher output per channel respectively. All multichannel heads available in epoxy or full metal face (to reduce oxide pickup) at no extra charge.

* Patent Pending

Answer: **All but this one.**

Here is a *medium*-scale general purpose digital computer, and the only small-scale thing about it is the price. It's the low-price Bendix G-15.

Part of the remarkable success of the G-15 is due to that low price. One user writes, "*. . . the nearest competitor to the G-15 costs five times as much.*"

There are many other reasons why hundreds of computer experts have chosen the G-15. Versatility is one. The G-15 is well-equipped to handle all phases of business data processing as well as highly complex scientific and engineering calculations. Also, simplified programming methods allow your present personnel to solve their own problems on the computer.

A broad line of accessories means the G-15 is expandable. As the work increases, you can add magnetic tape units, punched card equipment, and other accessories. Don't forget, however, that the basic G-15, with its photoelectric paper tape reader-punch and electric typewriter, is more than adequate for most problems.

Other features you will like are: true alphanumeric input-output, high internal speed, buffering, large program library and user's exchange group, and fast nation-wide service.

Bendix® Computer

Complete details will be sent upon request. Mention specific problems where the G-15 may be helpful, and we will be glad to advise you.

DIVISION, DEPT. E-14. LOS ANGELES 45, CALIFORNIA

Experienced programmers, sales and service personnel . . . share our growth. Contact O. P. Staderman, Director of Marketing.

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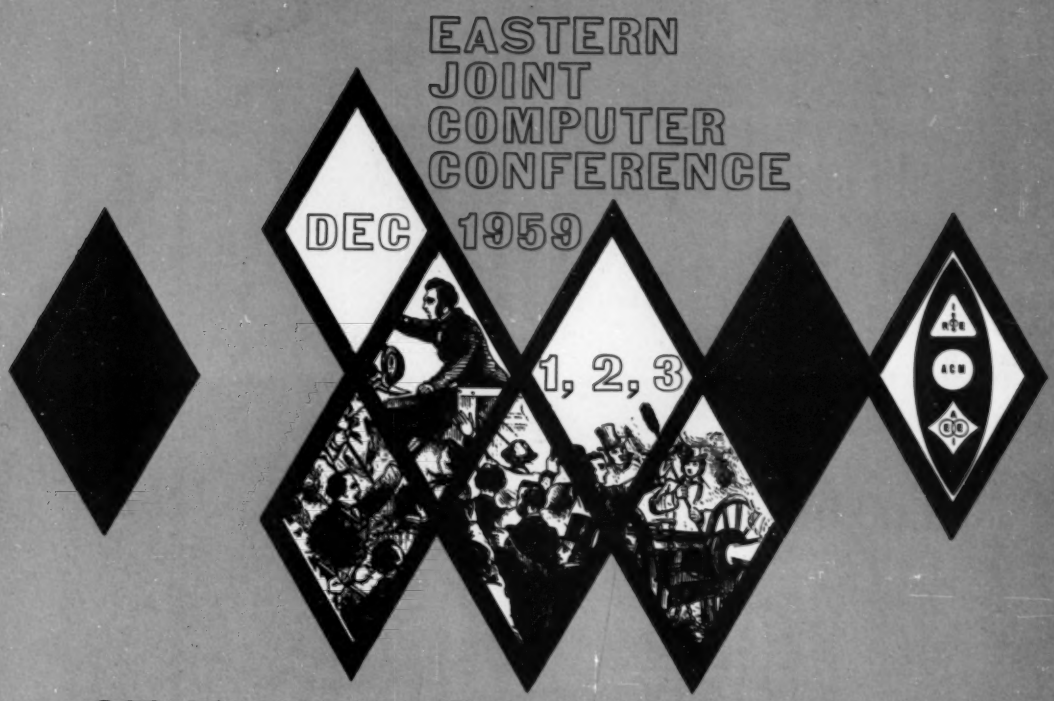

STATLER HILTON HOTEL, BOSTON

Frank E. Heart

A WELCOME

It is a pleasure to accept DATAMATION's generous coverage of the 1959 Eastern Joint Computer Conference and to take this advance opportunity to welcome you to Boston, the Statler Hilton Hotel, and the conference.

In the present-day world of overlapping professional societies, conferences by the multitude, and burgeoning technical literature, it is very difficult for an individual to select the right conferences to attend. I would like to offer several reasons why the 1959 Eastern Joint Computer Conference deserves your attention.

First, the joint AIEE-IRE-ACM sponsorship has always encouraged the presentation of new material over a very broad range of interests. This year a narrowly defined theme has been deliberately avoided, and the technical program ranges over wide areas of design and application. Second, for this 1959 EJCC, a group of dedicated people have sincerely tried to choose papers of real importance and to eliminate trite or marginal material. Although many high-quality papers were submitted, barely 20% were accorded a place on the program. Third, we are hoping that the elimination of parallel sessions and the inauguration of a $300 prize for "best presentation" will substantially improve the connection between the speakers and the audience. Fourth, the peripheral functions—the technical trips, the commercial exhibits, the luncheon and dinner and the management of the registration area—are being planned with considerable care in order to provide a pleasant and useful background for the technical program. Finally, as a special attraction, a report will be given by the National Joint Computer Committee concerning a recent comprehensive tour of Russian computer technology.

For many of us, the computer art is still more than just a job. At age 10 or 15, it continues to represent a bright shiny new field whose eventual impact upon society will be exceedingly large. Previous EJCC's have occasionally provided clear glimpses of this future, and I believe that the 1959 EJCC will also provide a stimulating "forward look" and a useful forum for the exchange of ideas.

Frank E. Heart
Chairman, 1959 EJCC

No other computer

costing hundreds of thousands more

can match the computing capacity, high speed, and performance of the new **1604** computer

You can see this fully operating computer in our plant. You can also see being built into other 1604's the skill and craftsmanship that insure quality and make delivery extremely short.

FACTS FOR THE TECHNICAL STAFF

HIGH CAPACITY INPUT-OUTPUT (standard equipment): 3 buffer input and 3 buffer output channels. 1 high-speed 48-bit input transfer channel. 1 high-speed 48-bit output transfer channel. As fast as 4.8 μs average per 48-bit word.

SOLID-STATE CONSTRUCTION: Diode Logic. Transistor Amplifiers. Magnetic Core Storage.

MAGNETIC CORE STORAGE: 32,768 48-bit words. Store data or 2 instructions at any address. 2.2 μs read access time. 6.4 μs cycle time. 4.8 μs effective cycle time.

VERSATILE INSTRUCTION LIST: 62 main instructions expand into many sub-instructions. Provides for: Floating Point. Multiple Precision. Masking. Program Interrupt. Indirect Addressing. Buffered Input-Output. Breakpoint.

OPERATING MODE: Parallel-Binary. Programmable to alphanumeric, binary coded decimal.

TYPE OF LOGIC: Single Address, 2 instructions per word.

REAL-TIME CLOCK: For on-line applications.

PROGRAM INTERRUPT: For input-output equipment and fault indications.

INDIRECT ADDRESSING: Provides advanced data processing ability.

COMPATIBILITY: With majority of other manufacturers' peripheral equipment.

MODEL 1607 MAGNETIC TAPE SYSTEM: Four 30KC tape handlers per system. 48-bit assembly-disassembly registers. Simultaneous read-write. Parity check. Binary and Alpha-numeric recording. Four 24 tape handlers per Model 1604.

There are reasons why Control Data, and only Control Data, can give you so much at such a low cost. See for yourself before you invest much, much more than you need to. Write for free literature today.

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CONFERENCE PARTICULARS

An Eastern Joint Computer Conference with somewhat of a new look will convene in Boston during the first three days of December.

Conference Chairman Heart has pointed out many improved features in his message of welcome on page 29 and we would like to underscore two of these points, and mention still another.

The scheduling of single sessions will prove a great relief to most conference veterans. The $300 pot of gold at the end of the third day will probably go further toward inproving a paper's content and a speaker's delivery than 300 editorials. And finally, the scheduling of the organized "bull sessions" Wednesday night (see page 45), will delight those who insist that the greatest exchange of information takes place where many opinions can be voiced. Four panel discussions will be held.

Now to particulars of the conference—seven technical sessions will explore a broad range of subjects dealing with the manufacture and use of computers. Two exhibit areas (80 booths) will afford 55 firms the opportunity to display their wares.

All joint computer conferences are sponsored by the Institute of Radio Engineers, the American Institute of Electrical Engineers, and the Association for Computing Machinery.

A three-hour conference registration period will be held on November 30 from 6 to 9 p.m. (the day before the conference begins). Advance registrants who have met the November 15 deadline may pick up conference kits and last-minute notices upon arrival at the Statler-Hilton.

Conference registration will begin again at 8 a.m. on December 1, and will continue throughout the conference. Registration fees are $5 for a member of a sponsoring society, $7 for non-members and $1 for students with identification cards.

The exhibit area is located in two sections—on the mezzanine floor and on the fourth floor adjacent to the meeting rooms. Admission is free and the area may be visited by the general public.

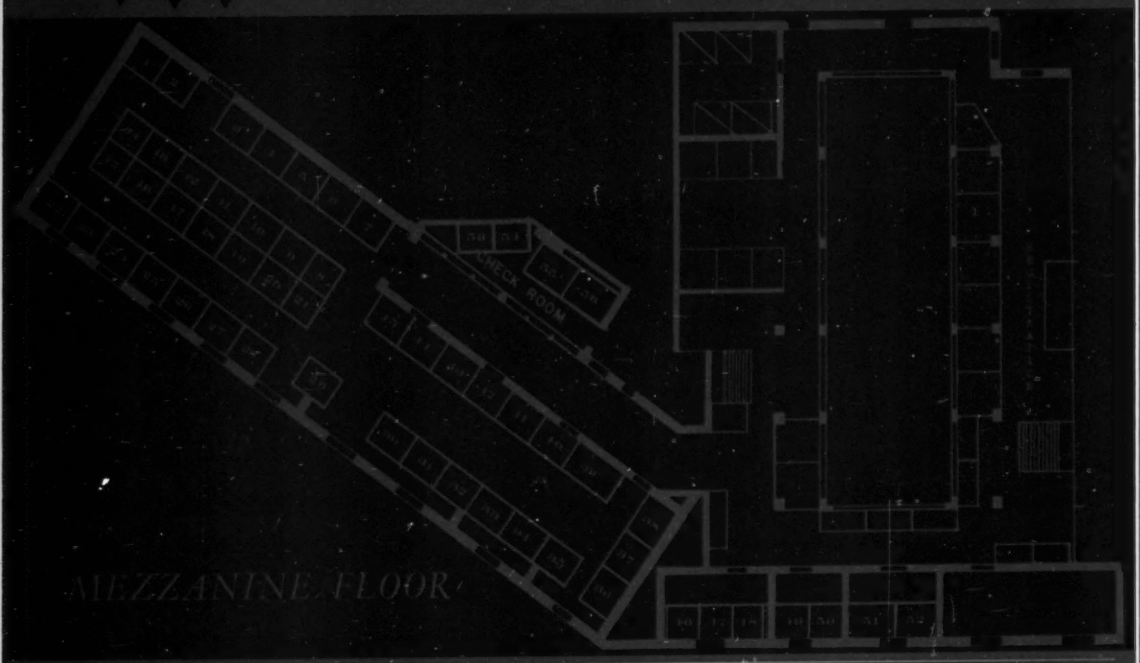
Installation of exhibits may begin at 7 a.m. on November 30. Exhibits will be open at these times during the conference: Tuesday, December 1, from 10:00 a.m. to 9:00 p.m.; Wednesday, December 2, from 9:30 a.m. to 6:00 p.m.; and Thursday, December 3, from 9:30 a.m. to 5:00 p.m. Deadline for removal of exhibits is Midnight, December 3. For a list of EJCC exhibitors and a map of the exhibit area, please turn to pages 32 and 33.

A reception will be held on December 1 at the Statler-Hilton. Price will be $4.50 per person. The dinner and award presentation will be held on December 3 in the main ballroom, 6:00 to 8:00 p.m. Price will be $7.50 per person. Details of this event will be found on page 46.

The conference committee has not planned a hectic schedule for wives attending the conference. Instead, there will be a coffee hour held each morning where the women can get together and plan their days. Problable site of the coffee hour will be the Bay State Room. Services of the Greater Boston Chamber of Commerce will also be available.

A copy of the conference proceedings will be sent, at no charge, to all conference registrants. Additional copies may be ordered at the conference or from any of the three sponsoring societies' headquarters at a cost of $3.00 including postage.

EXHIBITORS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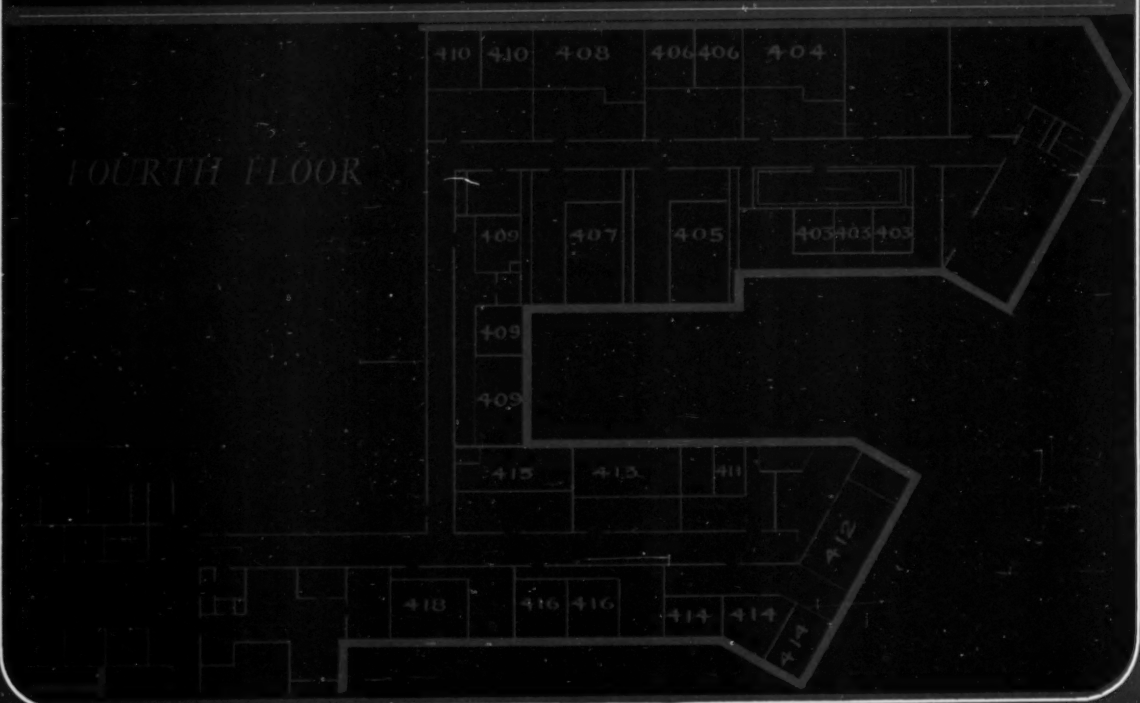
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Aeronutronic 27, 28
A Division of Ford Motor Company
Ford Road
Newport Beach, California

AMP, Inc. 34, 35
Eisenhower Boulevard
Harrisburg, Pennsylvania

Ampex Corporation 51, 52
934 Charter Street
Redwood City, California
magnetic tape records, digital tape handlers.

Autonetics 46, 47, 48
A Division of North American Aviation, Inc.
International Airport
Los Angeles 45, California
Autonetics computer, Recomp

Bendix Computer Division 44, 45
Bendix Aviation Corporation
5630 Arbor Vitae Street
Los Angeles 45, California
G-15 general purpose digital computer

Bryant Computer Products Division .. 17
123 Main Street
Springfield, Vermont
magnetic storage drums and associated components.

Burroughs Corporation 30, 31, 32
ElectroData Division
460 Sierra Madre Villa
Pasadena, California
220 printer system, 220 photoreader.

California Computer Products, Inc. 53
8714 Cleta Street
Downey, California

C-E-I-R, Inc. 18, 19
1200 Jefferson Davis Highway
Arlington 2, Virginia
IBM 704, IBM 705, IBM 709 computing services.

C. P. Clare & Company 33
3101 W. Pratt Boulevard
Chicago 45, Illinois

Computer Control Company, Inc. . 12, 13
983 Concord Street
Framingham, Mass.
digital computer modules, random access core memories, binary decades, nixie drivers, engineering and mathematical services.

Digital Equipment Corporation .. 41, 42
Maynard, Mass.
DEC digital building blocks, DEC digital test equipment, DEC system building blocks.

General Electric Company 14
Light Military Electronics Department
600 Main Street
Johnson City, New York
GEVIC variable increment digital computer

Harford Metal Products, Inc. 54
Aberdeen, Maryland

Instrument Specialties Company, Inc. . 55
244 Bergen Boulevard
Little Falls, New Jersey

International Business Machines Corporation 22, 23, 24
590 Madison Avenue
New York 22, New York
data processing equipment and components.

Laboratory for Electronics, Inc. 8, 9
1079 Commonwealth Avenue
Boston 15, Massachusetts

Librascope, Inc. 15, 16
808 Western Avenue
Glendale 1, California

Lumatron Electronics, Inc. 25
68 Urban Avenue
Westbury, New York

Minneapolis-Honeywell Regulator Company 39, 40
DATAmatic Division
151 Needham Street
Newton Highlands 61, Massachusetts
Honeywell 800 all-transistorized data processor.

Minnesota Mining and Manufacturing Company 43
900 Bush Avenue
St. Paul 6, Minnesota
"Scotch" brand magnetic tape and accessories.

George A. Philbrick Researches, Inc. 20, 21
285 Columbus Avenue
Boston 16, Massachusetts
electronic analog computers and components.

Philco Corporation 49, 50
Government & Industrial Division
4700 Wissahickon Avenue
Philadelphia 44, Pennsylvania
Transac S-2000 data processing system.

Remington Rand Univac Division 3, 4, 5, 6, 7
Sperry Rand Corporation
315 Fourth Avenue
New York 10, New York

Rese Engineering, Inc. 29
731 Arch Street
Philadelphia 6, Pennsylvania
automatic memory core test system

Stromberg-Carlson-San Diego 10, 11
1895 Hancock Street
San Diego, California

Sprague Electric Company 56
Marshall Street
North Adams, Massachusetts

Sylvania Electronic Systems .. 36, 37, 38
A Division of Sylvania Electric Products, Inc.
63 Second Avenue
Waltham 54, Massachusetts
data processing systems

Union Switch & Signal 1, 2
Division of Westinghouse Air Brake Company
Pittsburgh 18, Pennsylvania
readout instruments, miniature relays.

Wang Laboratories, Inc. 26
37 Hurley Street
Cambridge 41, Massachusetts
paper tape readers, plug-in units, printed circuit units, logical elements, pulse generators.

FOURTH FLOOR

Amerian Telephone and Telegraph Company 412
32 Avenue of the Americas
New York 13, New York

Anelex Corporation 403
150 Causeway Street
Boston 14, Massachusetts

Benson-Lehner Corporation 411
1860 Franklin Street
Santa Monica, California
high speed digital plotter with magnetic tape input, data reduction equipment.

Di-An Controls, Inc. 414
40 Leon Street
Boston, Massachusetts
buffer storage systems, memories, magnetic shift registers, digital building blocks and accessory units.

Digitronics Corporation 416
Albertson Avenue
Albertson, New York

ELCO Corporation 411
"M" Street below Erie Avenue
Philadelphia 24, Pennsylvania

Electro Measurements Company ... 416
Lewis Street and Maple Avenue
Eatontown, New Jersey

Electronic Associates, Inc. 405
Long Branch Avenue
Long Branch, New Jersey

Engineered Electronics Company ... 409
506 East First Street
Santa Ana, California

Fairchild Semiconductor Corporation . 414
545 Whisman Road
Mountain View, California
2N706 switching transistor optimized for use in saturating logic circuits, 2N1252 and 2N1253 low storage time double diffused silicon mesa transistors

Ferranti Electric, Inc. 403
95 Madison Avenue
Hempstead, New York
photo electric tape readers, magnetic striction delay lines, high speed light sources, photo sensing elements.

Friden, Inc. 416
2350 Washington Avenue
San Leandro, California
computyper, flexowriter, teledata, add-punch and input and output devices.

General Ceramics Corporation 413
Keasbey, New Jersey
magnetic core memories, memory planes, memory cores, ferrite cores for pulse transformers, recording heads, delay lines, multi-aperature devices, etc.

The Gerber Scientific Instrument Company 406
89 Spruce Street
Hartford, Connecticut
X-Y platters, instruments and systems for data reduction.

GPS Instrument Co. 406
180 Needham Street
Newton, Massachusetts

Harvey-Wells Electronics, Inc. 410
5168 Washington Street
West Roxbury, Massachusetts

Micro Switch 406
Div. Minneapolis-Honeywell Regulator Company
151 Needham Street
Newton, Massachusetts

The National Cash Register Company 408
Dayton 9, Ohio

Packard Bell Computer Corporation . 409
1905 Armacost Avenue
Los Angeles 45, California
voltage to digital converters, printed circuit units, magnetic core shift registers, and digital systems.

Potter Instrument Company, Inc. 418
Sunnyside Boulevard
Plainview, New York
high speed military and commercial printers, tape transports (magnetic and perforated).

Radio Corporation of America 415
Camden 2, New Jersey

Ramo-Wooldridge Division 412
Thompson Ramo Wooldridge Inc.
5500 W. El Segundo Blvd.
Los Angeles 45, Calif.

Royal McBee Corp. 412
Port Chester, New York

Reeves Soundcraft Corporation 403
Great Pasture Road
Danbury, Connecticut
magnetic recording tape and accessories.

Tally Register Corporation 414
5300 14th Avenue, N.W.
Seattle 7, Washington

Telemeter Magnetics, Inc. 407
2245 Pontius Avenue
Los Angeles 64, California
random access memory, data storage components.

Teletype Corporation 404
4100 Fullerton Avenue
Chicago 39, Illinois

F. D. Thompson Publications, Inc. .. 409
141 East 44th Street
New York 17, New York
DATAMATION magazine.

John Wiley & Sons, Inc. 410
440 Fourth Avenue
New York 16, New York

TECHNICAL PROGRAM INTRODUCTION

The technical program of the 1959 Eastern Joint Computer Conference will include papers on as wide a range of subjects in the computer field as there are stages in the development of a computer. The scope includes: unusual applications for existing computers; system and logic design of announced computers; improved components for new computers; novel system organizations for special applications.

While many people in the computer industry specialize in one technical area, many papers at this year's EJCC will be of broad interest, even to specialists, since they mark important advances in the art.

At the 1956 EJCC, descriptions were given of two machines—then in early stages of development—whose operating speeds portended to be higher by two orders of magnitude than existing machines. The LARC and STRETCH computers are now almost ready for delivery. At this year's conference their manufacturers will report on the performance achieved and the problems which have been overcome in realizing this performance.

As faster machines become available, so more complex problems are presented which tax the capabilities of the newest machines. The government is sponsoring a research project to study components suitable for the next generation of even faster and more powerful computing systems. Two of the firms working on Project Lightning will describe their progress with solid-state microwave components and with thin magnetic films.

The problem of getting printed or written information into a machine has received considerable attention recently. The final technical session will include a description of how a computer was used to facilitate the designing of character-recognition logic, and reports on initial results obtained with each of three different techniques for character recognition. A panel of invited experts will discuss the ideas presented in these papers, and their relation to other work accomplished or under way in this field.

On Wednesday evening, four different panels of experts will each discuss a topic of current interest. These sessions are intended to bring together the people whose professional interests are concentrated in these respective areas to encourage a free interchange of information and ideas. The subjects for discussion will be: 1) The problem of devising equivalent circuits for components, and especially the difference between the complex equivalent circuit which represents the behaviour of the device to the satisfaction of the physicist, and the equivalent circuit which is simple enough to permit steady-state and transient analysis of circuit behavior; 2) The various ways in which computers are now being used to simplify the development of large digital systems; 3) The problems which will arise in building systems using the kilo-megacycle components which are in the research and development stages; 4) The problem of obtaining from a computer the correct answer to the proper question, in a form convenient to the user.

Jean H. Felker
Program Chairman

Jean H. Felker, senior member of the IRE, and past Chairman of the Professional Group on Electronic Computers, joined the Bell Telephone Laboratories in 1945, as a member of the technical staff. He was in charge of development of TRADIC, a transistor computer completed in 1954, and in 1955 was made Director of Special Systems Engineering II—planning data processing and data communication facilities. He was recently appointed Transmission Engineer for the Bell System and transferred to the American Telephone and Telegraph Company.

THE PROGRAM

Tuesday

Tuesday, December 1, 1959 10:00 am.-12:00 noon
Conference Welcome – Chairman: Frank E. Heart, Lincoln Laboratories.

COMPUTERS OF THE FUTURE
Speaker: R. Rice, IBM

This discussion is concerned with a radical change in the technology utilized to manufacture digital data processing systems. A picture of the effect of this change on our way of specifying and designing systems is presented. Present methods of circuit-system standardization are contrasted with anticipated future methods. An illustrative example of "System Function" design and "System Tailored" circuits and devices is given. A summary is made of the more important work required in order to progress from present to desired future systems.

NEGATIVE-RESISTANCE ELEMENTS AS DIGITAL COMPUTER COMPONENTS
Speaker: Morton H. Lewin, RCA Laboratories

The use of two-terminal negative-resistance devices as the basic switching elements in a digital system is discussed. Two fundamental problems analyzed are concerned with:

1. *Achieving logical gain at maximum possible repetition rate.*
2. *Providing means to dictate the direction of flow of information in the system.*

Circuits performing all the essential logical functions are presented, utilizing the "tunnel (Esaki) diode," a new high-speed negative-resistance semiconductor device, as the basic element. Single-ended and balanced circuit configurations are discussed. In addition, simple arrangements of a small number of tunnel diodes are derived to realize more complicated logical functions. Part of the system described is a three-phase pulse power supply. Utilizing such a power source, all storage functions can be realized by dynamic storage techniques.

Tuesday Afternoon 2:00 p.m.-5:00 p.m.
Chairman: Howard Aiken, Harvard Computation Laboratory

DEPOSITED MAGNETIC FILMS AS LOGIC ELEMENTS
Speakers: A. Franck, G. Marette, B. Parsegyan, Remington Rand Univac

Deposited magnetic films have exhibited logical properties that portend their use as other than memory elements in computer applications. These logical modes of operation are explained as they pertain to a logical device, specifically a scale factoring circuit. The principles of array logic are defined wherein multiple copies of a word are used along with the proper arrangement and selection of sense lines linking these words to obtain the desired result in a single operation rather than a series of sequential operations. The advantages of deposited magnetic films in this application are enumerated in detail in the paper.

SOLID STATE MICROWAVE HIGH SPEED COMPUTERS
Speaker: Jan A. Rajchman, RCA Laboratories

Two types of semi-conductor devices offer possibilities to speed computer rates up to thousand megacycles. (1) Variable capacity diodes in parametric subharmonic phase locked oscillators have permitted pumping up to 10 KMC and making of 4 KMC-pumped 100 mc logic circuits. Junction type diodes of order of magnitude higher speed capability were developed. (2) Tunnel diodes switching in less than 10^{-9} seconds were developed. Scaled-down frequency logic pulse type circuits were demonstrated. Arrays of tunnel diodes promise random access memories with access cycles of 10^{-8} to 10^{-7} seconds. Both diodes were developed in microcapsules fitting within microwave transmission boards and dissipate sufficiently low power to permit necessary high packing density for ultra fast computers. Special circuit techniques for use of two terminal single port devices were developed.

THE ENGINEERING DESIGN OF THE STRETCH COMPUTER
Speaker: Erich Bloch, IBM

The engineering design of the Stretch Computer will be described, emphasizing the detailed internal organization of the major units and systems, such as Indexing units, the Floating Point Arithmetic units, the Lookahead, and the Memory bus. The logical circuit and general package will be briefly mentioned.

DESIGN OF THE LARC SYSTEM (Two Parts)
Speakers (Part One): J. P. Eckert, J. C. Chu, A. B. Tonik

A review of the LARC specifications to point out how closely the system constructed conforms to the specifications as announced several years ago. The various levels of memory that are available in the system will be described. The advantages of the particular arrangement of the memories employed will be contrasted to other possible memory arrangements which could have been employed but which would have been difficult to program and would have limited the flexibility of the system. The speeds of operation will be discussed along with how these speeds are achieved by overlapped operation and parallelism. The controlling of several semi-independent programs as well as input-ouput operations will be discussed.

Speakers (Part Two): H. Lukoff, L. M. Spandorfer, F. F. Lee, Remington Rand

The method of selection of the circuitry is discussed and is based on an optimization of cost, speed and logical capabilities. The fabrication of these circuits into an operating system is then covered with emphasis on the connector design, packaging considerations, noise problems and maintenance features. Success of the system was dependent upon development of packaging techniques that permitted very high packing densities. Mechanized backboard wiring techniques were used to achieve highest circuit speeds. Fine steel core wire is used for all wiring, which required the development of handling techniques. Methods of working with high component densities are discussed. Solid state regulated power supplies provide reliable operation. The present status of the system is discussed.

Wednesday

Wednesday, December 2, 1959 9:00 a.m.-12:00 noon
Chairman: Morris Rubinoff, Moore School of Electrical Engineering

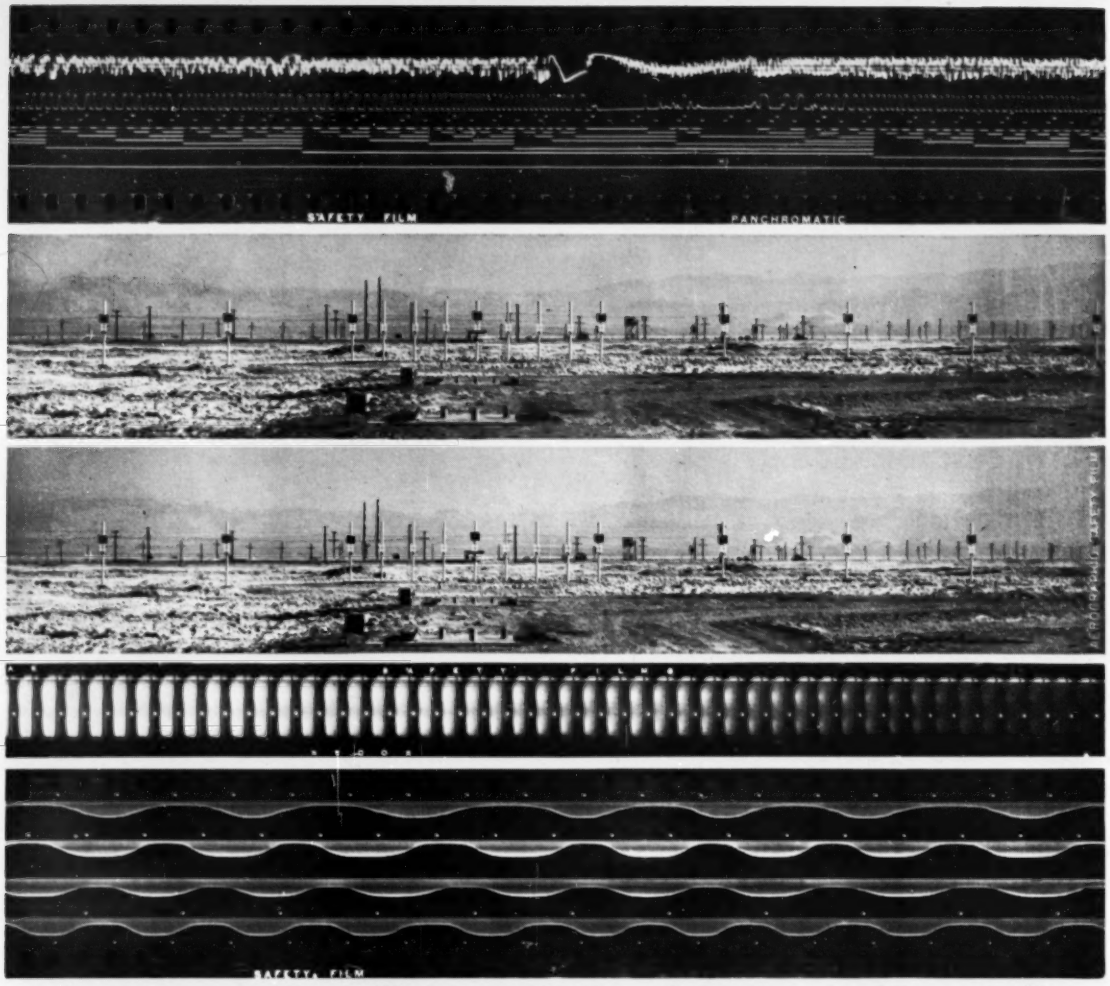
CONTROL AND ARITHMETIC TECHNIQUES IN A MULTI-PROGRAMMED COMPUTER
Speakers: Norman Lourie, Henry Schrimpf, Roy Reach, William Kahn, Datamatic Division of Minneapolis-Honeywell Regulator Co.

This paper describes how a 256 word 20 bit coincident current memory, operating out of phase with the main storage memory, can be efficiently utilized to aid in the performance of relatively complicated control functions in a digital computer with no loss in machine speed. These functions include such things as 16 sequencing counters to automatically control up to 8 independent programs, buffering controls for 64 peripheral devices, indexing and tabular control of main memory addresses. A parallel-serial parallel bit configuration of data is described which allows some time sharing of the adder circuitry. The resultant speeds approach that of an all parallel system, but require not nearly as much equipment. It is easily adapted to perform addition and subtraction in either binary or decimal codes.

THE VIRTUAL MEMORY IN THE STRETCH COMPUTER
Speakers: John Cocke, Harwood G. Kolsky, IBM

The use of high speed logical devices and more sophisticated design methods has resulted in an imbalance between the arithmetic and memory speeds. The Virtual Memory provides a method of "looking-ahead" in order to permit the simultaneous operation of several blocks of memory in an asynchronous computer while maintaining logical correctness. Machine speed is further increased by overlapping the book-keeping operations with the principal computations. To measure the effectiveness of the Virtual Memory, a timing simulation program for STRETCH was written on the IBM 704. This program enables us to study a wide variety of parameters for design optimization.

(Continued on page 41)



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Now you can greatly increase efficiency in film data handling! The Data Instruments' DILOG 510 provides the easiest method to obtain rapid and complete film analysis . . . *from any kind of film records.* The DILOG 510 accepts 16mm, 35mm, and 70mm film—stop motion, cine-motion, and flow . . . any kind of data is rapidly and accurately translated from film to digital form. The data may be automatically punched into cards or paper—plotted—typed on an electric typewriter—or any desired combination. Ask for the complete story of film reading equipment: there is a DILOG system to fit your needs. Write, wire, or phone!

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58 FACTS PROVE THE MC-5800 OBSOLETES EVERY OTHER ANALOG COMPUTER MADE

solves problems faster, more accurately, and at less cost!

The MC-5800 provides FASTER answers

1. Selection of real-time, expanded-time or high-speed compressed-time without reprogramming.

2. Real-time precision @ speeds to 60 solutions/sec.

3. Dynamic memory with time-base accuracy of ±10 μsec provides automatic parameter searching by iteration—an exclusive capability.

4. It programs 134 amplifiers, 30 electronic multipliers, 18 diode function generators, 2 time-delay generators, 8 relay amplifiers, and 6 servos from one 2128-hole patchboard.

5. Unique automatic problem check checks problem-board patching in seconds and can record errors.

6. Exclusive electronic generators of the function of two-or-more variables may be programmed at patchboard in same time required for setup of single-variable generators.

7. Complete control of all amplifiers, multipliers, dividers, and non-linear equipment at patchboard.

8. Quick overload recovery in less than 1 sec.

9. It is the only computer offering card-programmed diode function generators.

The MC-5800 performs MORE ACCURATELY

10. Amplifiers provide lowest noise level output—less than one millivolt at unity gain.

11. Greatest distortion-free amplifier output—30 mils at ± 120 V—only 12 mils quiescent drain.

12. Lowest amplifier grid-current $< 10^{-9}$ ampere.

13. Stable amplifier operation over the entire feedback range from zero to infinity.

14. Drift < 50 μv in 8 hours in summing mode.

15. Amplifier frequency response—flat to 10,000 cps and only 3 db down at 28 kc.

16. Only diode function generators utilizing resistors, potentiometers, and diodes of equal quality to those in computing networks.

17. Only diode function generators with individual hi-lo gain positions for *each* segment.

18. Lowest function generator drift < 5 mv/8 hrs.

19. Highest servo multiplier accuracy, ±0.008%.

20. Only fully shielded patch *bay* and patchboard.

21. All contacts in patching system gold-plated.

22. Highest performance electronic multiplier—flat to 10,000 cps and only 3 db down at 20 kc.

23. Only servo multipliers and resolvers with zero backlash gearing—maximum one part in 36,000.

24. DC tachometer feedback on all servos.

25. Dynamic servo error—less than 50 mv at one cps.

26. Lowest step-function overshoot—less than 1%.

27. EVERY SPECIFICATION IS GUARANTEED TO BE TRUE PERFORMANCE STANDARD—IN SUSTAINED OPERATION.

28. Highest sin-cos resolver accuracy ±0.03% peak-to-peak.

29. Power supplies eliminated from console—lowest, most stable operating temperatures—rise < 3°C.

30. Passive networks stabilized at < 1°C above room ambient—no oven required.

31. Servo-set pots can be set to 2 parts in 10,000.

32. Accuracy of computing networks at least 0.01%.

33. Lowest computer cross-talk—rejection greater than 2,000 to 1.

The MC-5800 can be operated at LESS COST

34. Greatest available problem capacity per dollar—by 20%.

35. Least cost for future expansion.

36. Output tube filaments operate with DC bias for maximum life.

37. Centralized overload indication for quicker trouble-shooting.

38. Only computer with hermetically sealed transformers.

39. Choppers employ double-contacts in parallel for maximum life.

40. Plug-in relays and step switches throughout for least down time.

41. Plug-in dynamic components ease maintenance.

42. Quickest trouble-shooting by automatic problem check.

43. Costliest and best patching system for lowest programming cost thru maximum reliability of patchcord connections.

44. Choppers de-energized when computer in standby for max. life.

45. Separate power-supply venting minimizes room heat load.

46. Exclusive equipment-door packaging for free access and quick maintenance *without* shutdown.

47. Insulated patchboard prevents costly shorting accidents.

48. Sealed servo gear boxes for maximum reliability.

49. Fully transistorized ADRAC system with plug-in logic modules.

50. Available on lease basis as well as for purchase.

The MC-5800 can SOLVE MORE OF YOUR PROBLEMS

51. Exclusive dynamic memory makes automatic iterative solution of statistical or optimization problems a reality.

52. Dynamic memory + high-speed quick-reset rep-op provide practical approach to solution of simultaneous partial differential equations.

53. Exclusive bi-variable function generators can also be used as amplifiers, multipliers, or generators of single-variable functions.

54. More computer capacity per dollar means more solutions.

55. Solution of problems with up to 15 amplifiers in closed loops.

56. Starting with as few as ten amplifiers, at a cost of little more than the cheapest available computer, you can build to a complete computing center of unsurpassed performance.

57. Add-on capacity up to 134 amplifiers, 30 electronic multipliers, 18 diode function generators, 2 time-delay generators, 8 relays with amplifiers, 4 bi-variable function generators, 6 servos, 8 function switches—all field-expandable without mechanical rework or rewiring.

58. Add-on features include automatic problem check, integrator rate test, high-speed repetitive operation, dynamic memory, expanded-time base, compressed-time base, servo-set potentiometers, and ADRAC (Automatic Digital Recording and Control) system—all field expandable without mechanical rework or rewiring.

There are over 100 more facts—let us tell you about them in person, or better still, visit our factory—and see for yourself!

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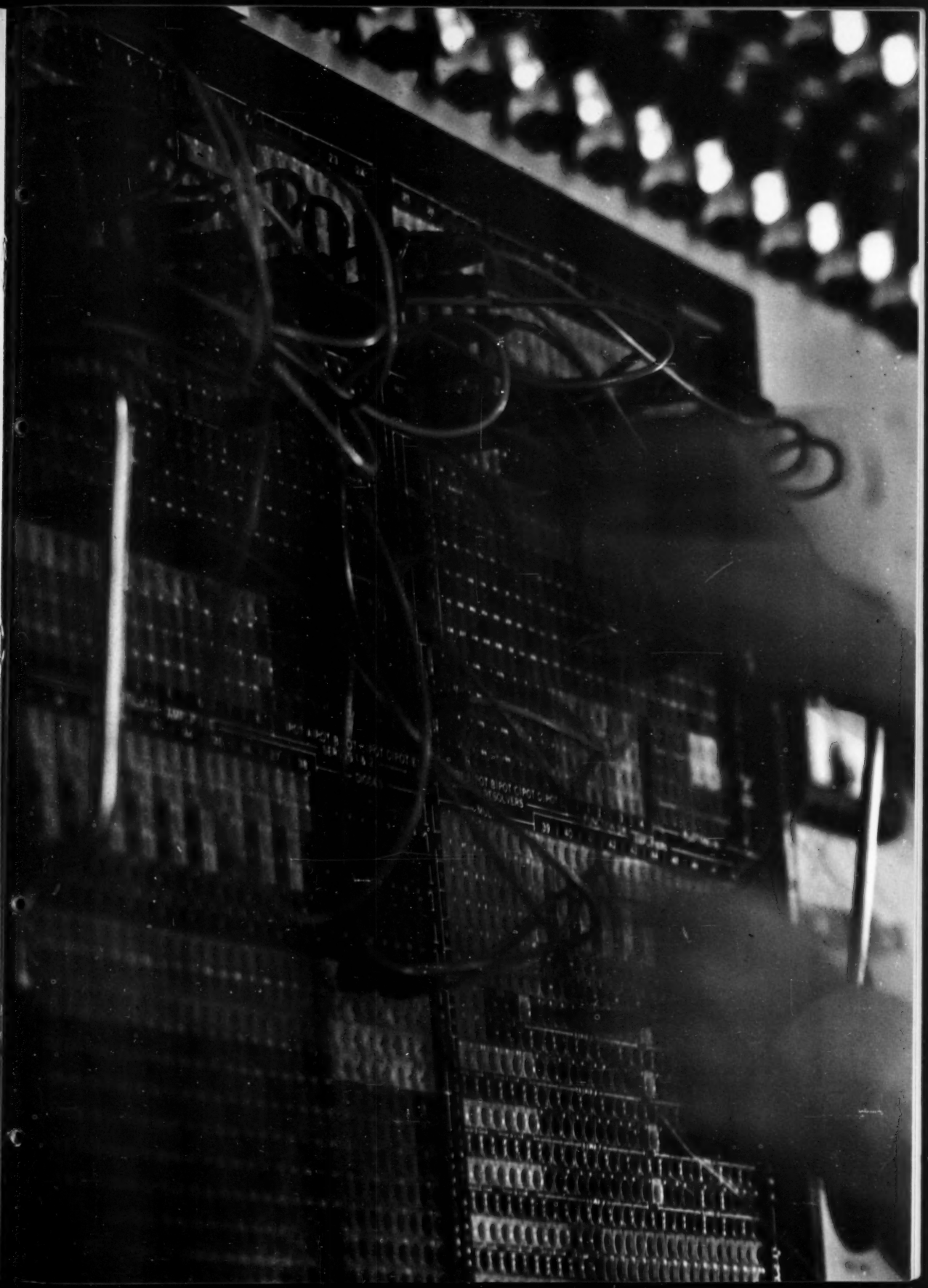

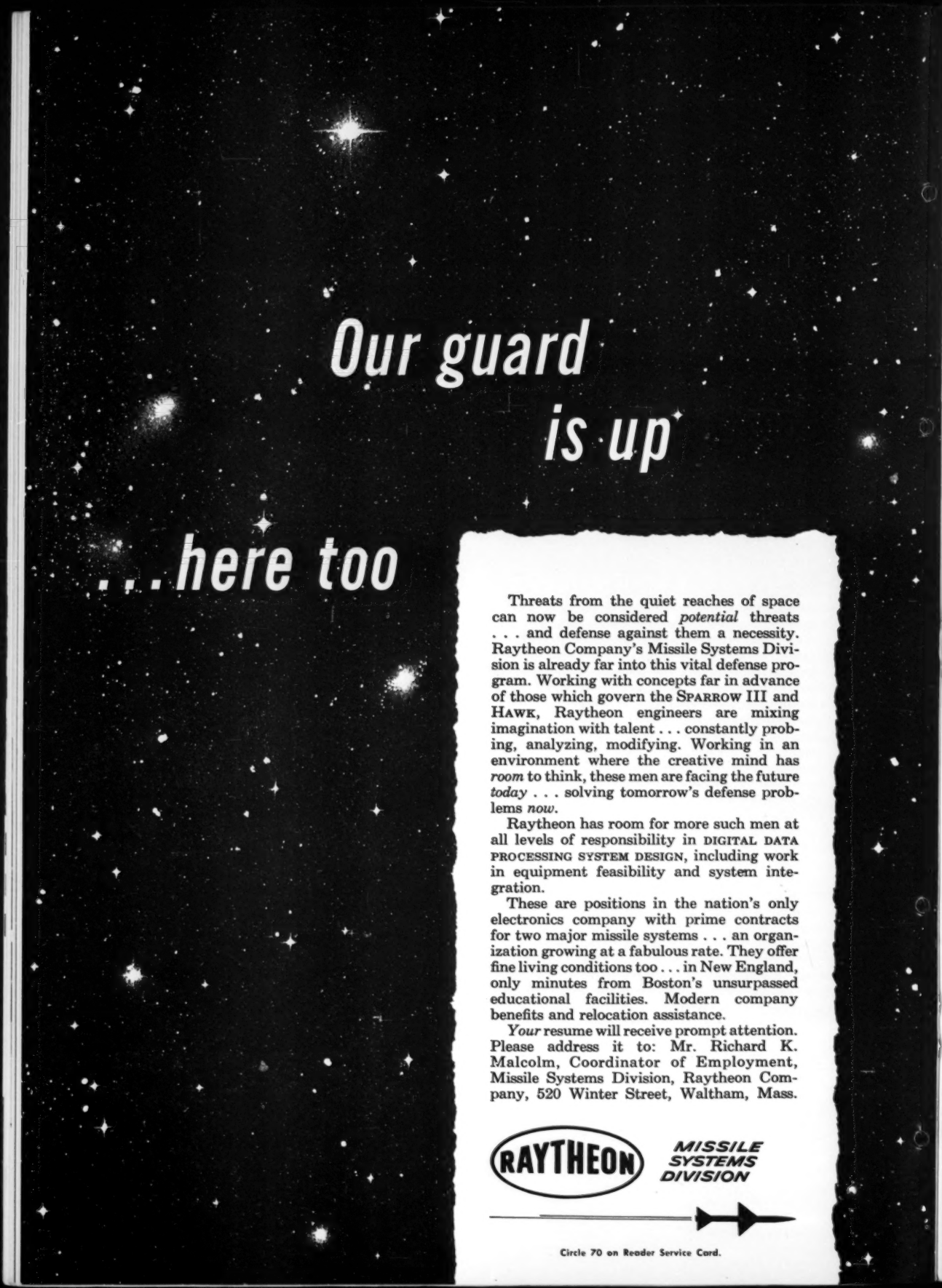

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THE PROGRAM

A COMBINED ANALOG-DIGITAL DIFFERENTIAL ANALYZER

Speaker: Harold K. Skramstad, National Bureau of Standards

An analog-digital differential analyzer has been designed which combines the analog advantages of high speed and continuous representation of variables with the digital capability of high precision and dynamic range. It is based on representing dependent variables by two quantities, a digital number representing the more significant part, and an electrical voltage representing the less significant part. As in the electronic analog computer, time is the independent variable. The design of components required to build a computer of this combined type, such as integrators, summers, and multipliers are given, and examples of how the solution of a few elementary differential equations would be carried out are presented.

THE SYSTEM ORGANIZATION OF MOBIDIC B

Speaker: Stanley K. Chao, Sylvania Electric Products

Mobidic B is an all transistorized, militarized computer mounted in a standard Army trailer. It is a general purpose, parallel, binary, synchronous, fixed point, and duplexed data processing system.

It contains two basic processors identical in characteristics, internally tied together to the same system transfer bus. Both processors share a common set of input-output devices. Each processor is capable of operating an independent program without interference. They are also capable of duplexed operation, allowing either processor to monitor and exert control over the other. In addition to the 8192-word high speed Core Memory in each processor, there exists a 50 million-bit Mass Memory. This memory is treated as an input-output device, addressable by in-out instructions. A Data Retrieval Unit is incorporated to facilitate data searching from the Magnetic Tape and Mass Memory.

A UNIVERSAL COMPUTER CAPABLE OF EXECUTING AN ARBITRARY NUMBER OF SUB-PROGRAMS SIMULTANEOUSLY

Speaker: John Holland, University of Michigan

The paper describes a universal computer capable of simultaneously executing an arbitrary number of sub-programs, the number of such sub-programs varying as a function of time under program control or as directed by input to the computer. Three features of the computer are:

1. *The structure of the computer is a 2-dimensional modular (or iterative) network.*
2. *Each sub-program is spatially organized, thus facilitating the simulation of "highly-parallel" systems having many points or parts.*
3. *The Computer's structure and behavior can, with simple generalizations, be formulated so as to make it a useful abstract tool for investigating problems in automata theory.*

Wednesday Afternoon 2:00 p.m.-5:00 p.m.

Chairman: Paul Armer, The RAND Corporation

THE MULTI-SEQUENCE COMPUTER AS A COMMUNICATIONS TOOL

Speaker: J. N. Ackley, International Electric Corp.

This paper describes possible applications, as a communications tool, of a multi-sequence computer in which more than one sequence or program operates independently, time-sharing the central processing unit. The computer is made to time-share on an on-demand basis between all of the input and output devices. The control sequences and the buffering can be provided by the central processing unit. A multi-sequence computer, which permits integration of a multiplicity of input and output devices economically, becomes a very rapid and economical message switching center by connecting the communications lines as the input and output devices. This configuration can also be exploited as a real time data processing system or a real time control system.

SYNTHESIS OF SWITCHING TWO TERMINALS BASED ON THE THEORY OF G. R. KIRCHHOFF AND O. VEBLEN

Speaker: Satio Okada, Brooklyn Polytechnic Institute

A routine procedure for determining minimum switching networks, non-series-parallel and non-single-contact in general, for any given Boolean polynomial R is exemplified.

APPLICATIONS OF BOOLEAN MATRICES TO THE ANALYSIS OF FLOW DIAGRAMS

Speaker: Reese T. Prosser, Lincoln Laboratories

An analysis of the structure of flow diagrams, such as those associated with computing machine programs, can be given in terms of Boolean matrices. With each such diagram is associated a pair of Boolean matrices. The first of these, called the connectivity matrix, contains the topological structure of the diagrams, and the second, called the precedence matrix, contains its precedence relations. Elementary computations on these matrices are shown to yield detailed information concerning the internal logical consistency of the flow diagram. Possible applications to automatic debugging procedures are suggested.

SIMCOM – THE SIMULATOR COMPILER

Speaker: Thomas Sanborn, Space Technology Laboratories

SIMCOM is a specialized compiler used in preparing computer-simulation programs. The input language consists of stylized "sentences" which specify the configuration of the computer to be simulated, and describe the bit-wise effect of each of the simulated computer's operations. Related sentences are grouped into "paragraphs" to minimize coded cross references in the simulation program. Because the compiler output is a symbolic code it can be generated during a single pass through the source program. This symbolic code is then processed by a conventional two-pass assembly program. Automatic storage allocation, and a novel form of subroutine add to the power of the system.

TECHNIQUES AND METHODS EMPLOYED IN A DIGITAL COMPUTER PROGRAM TO SOLVE GENERAL TRANSIENT HEAT TRANSFER PROBLEMS

Speakers: D. J. Campbell, Mrs. D. Vollenweider, General Electric

A method is presented for solving transient and steady state heat transfer problems. The digital computer program permits the analysis of three-dimensional problems with arbitrary geometry and various combined modes of heat transfer. An unusual manner of describing geometric configurations and of presenting input data in symbolic form is discussed. Aspects of input processing, testing, and organization are described. Further extensions of these methods and computational techniques are proposed.

(FOUR PANEL DISCUSSIONS WILL BE HELD AT A SPECIAL SESSION WEDNESDAY NIGHT. FOR DETAILS, SEE PAGE 45.)

Thursday

Thursday, December 3, 1959 9:00 a.m.-10:35 a.m

Chairman: A. L. Samuel, IBM

THE AUTOMATIC TRANSCRIPTION OF MACHINE SHORTHAND

Speaker: Gerard Salton, Harvard University & Sylvania Electric Products

The transformation of speech input into written output is an important part of many data processing problems. Since digitalized speech input cannot be readily recognized, it is suggested that machine shorthand notes be used as input to a computer process for the automatic production of written output. The basic theory of machine shorthand is briefly described. Thereafter, various methods for the transcription of machine shorthand are discussed. Many problems arising in the translation process are found to be similar to problems of interest in the machine translation of languages and in the analysis of speech. Computer routines for the production of comprehensible, although not syntactically or semantically unambiguous, English are described, and the computer output is demonstrated.

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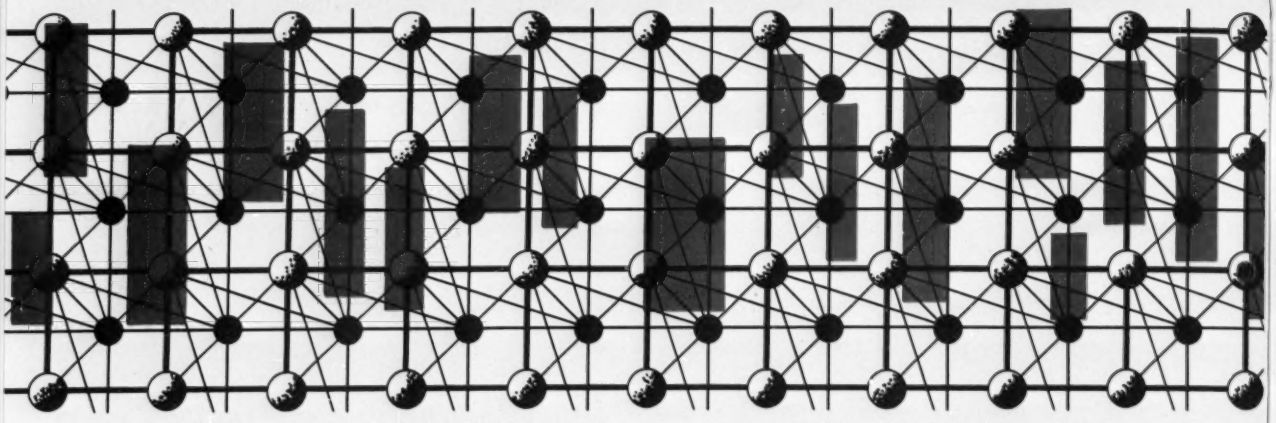

ITT Laboratories, the domestic research organization of International Telephone and Telegraph Corporation and long a leader in advanced electronics research and development, has been engaged for some years in digital computer engineering.

The Digital Systems Laboratory is engaged in projects of wide scope and magnitude embracing both commercial and military applications. Research and development centers on high speed, stored program machines; data switching and control; and commercial data processing applications. These developments incorporate major advances in machine organization and digital techniques. Prominent among the major projects in this Laboratory are the development of a worldwide communication and control system for the U. S. Air Force, and a solid state computer which will handle personal credit for a major New York City bank.

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THE PROGRAM

CRITICAL-PATH PLANNING AND SCHEDULING

Speakers: James E. Kelley, Jr., Morgan R. Walker, Mauchly Associates

Since January 1957 a technique for planning, scheduling and coordinating complex engineering-type projects has been developed, tested and applied. The essential ingredient of the technique is a working model of a project that incorporates sequence information, costs and durations for each component of the project. Parametric linear programming is used to combine these factors to produce optimal cost schedules having varying completion dates. Included is a complete system for cost accounting and computing and updating all project information. The rudiments of the technique, the history of the study and application results are discussed.

THE AUTOMATIC DIGITAL COMPUTER AS AN AID IN MEDICAL DIAGNOSIS

Speakers: C. B. Crumb, Jr., Bendix Systems Division, and C. E. Rupe, M.D., Henry Ford Hospital

The idea presented in this paper is that an automatic digital computer can provide great assistance to the medical diagnostician by rapid calculation, based upon symptoms and physical findings, of the relative probability that a certain physical disorder fits that set of findings. The plan calls for use of the computer to prepare statistical tables of correlation constants between patients' symptoms and various associated medical disorders; and to compute relative probabilities that various disorders fit a given set of symptoms. The paper describes the origins of the scheme, the plan for development of the technique, progress to date in execution of that plan.

Thursday Morning 10:55 a.m.-12:30 p.m.

Chairman: William N. Papian, Lincoln Laboratories

AN ADVANCED MAGNETIC TAPE SYSTEM FOR DATA PROCESSING

Speaker: Richard B. Lawrance, Datamatic Division of Minneapolis-Honeywell Regulator Co.

We describe a new magnetic tape mechanism, recording system, and information checking and restoration system of high reliability. In the mechanism, comparison is made between pinch-roller and vacuum capstan means for tape motion control. Criteria include minimization of tape deterioration both gradual and catastrophic, tracking, skew, and maintenance considerations. Systems techniques for enhancing tape system reliability are discussed briefly, with some emphasis on the use of error detection and automatic correction. The choice of information format on the tape and of error correcting parameters for maximum effectiveness is described.

A HIGH SPEED, SMALL SIZE MAGNETIC DRUM MEMORY UNIT FOR ULTRA SMALL DIGITAL COMPUTERS

Speakers: M. May, G. Miller, G. Shifrin, Ramo-Wooldridge

A magnetic memory drum has been designed and constructed for use in future aircraft and missile weapons systems. The drum has the following significant characteristics:

Overall Size—4" x 4" x 6"
Memory Capacity—300,000 bits stored on 122 tracks
Operating Bit Rate—546 kc
Speed—12,000 rpm

Ten circulating registers with a minimum length of 26 bits are also provided. The drum is ruggedly built to withstand MIL-E-5400 Class 2 specifications. It can stand shock loads of 16g and continuous vibrations of 5g peak from 0-2000 cps without the use of shock mounts.

TEMPERATURE COMPENSATION FOR A CORE MEMORY

Speakers: A. Ashley, E. Cohler, W. S. Humphrey, Sylvania Electric Products

For fixed installation, it is often possible to control the temperature of ferrite core memories within narrow limits. However, in a small mobile computer designed to operate over world-wide conditions, this control is not feasible because of the added weight, volume, and cost encountered. A memory designed for such application has been temperature compensated by the use of temperature sensitive components in the current sources to the x-y drivers and in the power supplies for the z drivers. In addition, core-derived strobing has provided peaking time compensation for the sense amplifiers as changes in transistor characteristics delay or advance drive current. This compensation permits operation of an 8192 word 38 bit transistorized memory running at an 8 microsecond cycle time in an ambient environment which may vary between —30°C and +55°C.

Thursday Afternoon 2:30 p.m.-5:00 p.m.

Chairman: Oliver G. Selfridge, Lincoln Laboratories

USE OF A COMPUTER TO DESIGN CHARACTER RECOGNITION LOGIC

Speaker: R. J. Evey, IBM

Character recognition logic for the IBM 1210 Sorter/Reader was developed with the aid of an IBM 704 computer. Characters printed with magnetic ink are quantized by the Sorter's scanning system into a 7 x 10 binary matrix which drives recognition logic of the AND and OR type. To develop this logic, computer programs which simulated the quantizing and the logic were used in conjunction with hardware that provided "real-life" character degradation. These programs and the procedure for developing the recognition logic are discussed.

A SELF ORGANIZING LOGICAL SYSTEM

Speaker: Richard L. Mattson, Lockheed Missiles and Space Division

A self-organizing logical system can be thought of as two systems; one, a network of adjustable logical devices which receive binary input combinations and operate on these to produce a binary output; the other, a system for determining what adjustments should be made in the logical devices to produce a desired logical function. By using the performance of the logical devices as a feedback to the adjusting system, optimum logical function synthesis can be obtained. In this paper a precise model for an adjustable logical device and a convergent iterative adjustment procedure is given and analyzed. Four demonstrations are given which made use of these logical devices and iterative procedure to synthesize an optimum function for pattern recognition problems containing from 25 to 216 binary variables. These problems were simulated on the IBM 704 computer and each problem required less than two minutes of computer time to synthesize the optimum truth function for the process considered.

ALPHA-NUMERIC CHARACTER RECOGNITION USING LOCAL OPERATIONS

Speaker: J. S. Bomba, Bell Telephone Laboratories

A demonstration of the recognition of thirty-four distinguishable handprinted, block capital, alpha-numeric characters is described. The basis of the recognition method is the use of "local operations" to extract significant features from the characters. The recognition procedure is: (1) reduce the noise in the field by local averaging, (2) standardize the character line width, (3) extract the "essential" features from the character (typical features are—straight lines of varying slopes and line intersections), (4) derive the relative locations and sizes of these features, (5) identify the characters from items (3) and (4) with combinational logic. The method was successfully evaluated with a simulation program on an IBM 704.

PATTERN RECOGNITION AND READING BY MACHINE

Speakers: O. G. Selfridge, Lincoln Laboratories, Ulric Neisser, Brandies University, Russell Kirsch, Bureau of Standards, M. Minsky, Lincoln Laboratories

An essential part of data processing by machine is pattern discrimination, characterization and mensuration. To accomplish this end, a means was devised and is being used to so treat patterns with an IBM 704. As a means of evaluating the discriminating capability of the system, typewritten numerals, hand-blocked print, and hand-written script were used as patterns of respectively increasing complexity and individual variability. All of these were recognized by a single, general purpose program from the initial patterns which were optically imaged on a 10 x 15 photocell matrix. Recognition was accomplished by individual character, and by contextual relationships.

WEDNESDAY NIGHT PANEL SESSIONS

Four small group discussions will be held on Wednesday evening, December 2. Each discussion will be led by a group of distinguished panelists, expert in their fields. Members of the audience will be able to exchange opinions with one another and with the discussion leaders. The subjects and panelists will be:

Large Signal Equivalents in the Analysis of Circuit Tolerance

Panelists – E. U. Cohler, Sylvania; R. J. Domenico, IBM; J. G. Linvill, Stanford Univ.; T. A. Murrell, Univ. of Illinois; R. L. Pritchard, Texas Instruments; W. J. Poppelbaum, Univ. of Illinois

The object of the panel discussion is to have some experts in the field air their views concerning:

1. The physicists approach to equivalent circuits for switching applications.
2. The models actually used by organizations designing computers.

Since the first group tends to think in terms of quite complex models, while the second group has to use the simplest possible equivalent representation, it is anticipated that considerable discussion will take place. Hopefully the result will be the acceptance of practically useful equivalents for transistors and diodes both for dc and transient analysis.

The Role of Computers in the Development of Digital Systems

Panelists – T. H. Crowley, Bell Telephone Labs; P. W. Case, IBM; W. Gordon, Datamatic Div., M-H; J. P. Malbrain, Ramo-Wooldridge; A. L. Leiner, National Bureau of Standards

The use of general purpose digital computers to aid in the development of digital systems has expanded greatly in recent years. A number of companies have announced the availablity of computer programs to do a portion of the routine engineering of new systems. Many companies are presently expanding such programs into something approaching an integrated system to carry out such functions as:

1. Performance of simple design jobs.
2. Simulation and checking of manual designs.
3. Record keeping and preparation of drawings.
4. Facilitation of changes.

In many aspects of this problem, different companies appear to be using similar techniques to achieve the same objectives. The panel will attempt to bring out those areas which involve special objectives or novel techniques. Panel members will discuss such topics as:

1. Comparison of existing programs.
2. Summary of experience with such programs.
3. Advantages and disadvantages.
4. Probable future extensions.

System Aspects of the Utilization of Kilo-Megacycle Components

Panelists – R. A. Kudlich, Bell Tel Labs; M. C. Andrews, IBM; J. P. Eckert, Sperry-Rand; S. Frankel, Consultant; D. L. Hogan, National Security Agency; R. E. Meagher, Univ. of Illinois.

Work now being done by various organizations gives promise that before very long we may have available components which are able to perform in the order of a billion logical operations a second.

The panel will discuss such problems as system organization, provision of storage facilities with suitable access speeds, input and output arrangements, signal propagation delays, heat dissipation, initial debugging and maintenance techniques, and appropriate applications for such systems.

Judicious Use of Your Computer

Panelists – J. A. Buckland, Shell Oil Co.; D. L. Johnson, Univ. of Washington; F. J. Maginniss, GE; L. N. McClung, Johns Hopkins Univ.; H. W. Richmond, SDC; H. Semarne, Douglas Aircraft Co.

The general purpose computer is no longer a novelty in industry. Its use at each industrial organization determines whether it is an economic tool or an expensive toy.

How are you using your computer?

Has a computer encouraged your organization to simplify computing procedures, to re-define old problems, and to investigate new endeavors?

Are your computer applications based primarily on computer availability or on problem requirements?

Does a knowledge of programming techniques influence the analysis of the problem?

Has automatic programming extended the range of new applications?

Does an occasional engineering application include a practical method which contradicts mathematical proof?

How much original research is attempted and required for each new problem?

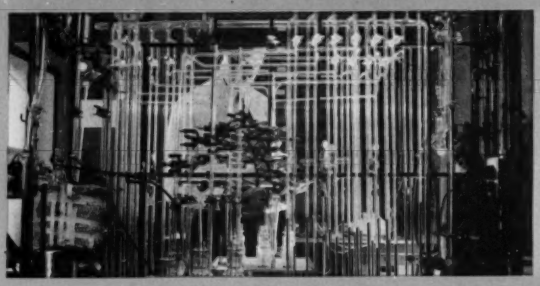
Do the engineers use the systems approach or the Topsy method when attacking a new computer application?

Has the solution or an intermediate result promoted further related studies?

What are some of the fringe benefits for the engineer and manager?

Leaders in the computing field have been invited to discuss these and similar questions on applications with the engineers, programmers, managers, analysts.

Aerial view of MIT's Lincoln Laboratory



A. D. Little scientist at work in lab

Willis H. Ware was Conference Chairman of the 1958 WJCC; Finance Chairman of the 1957 WJCC; serves as a member of the I.R.E. national Ad Hoc Committee; and was a member of the Technical Program Committee of the recent ICIP. In 1946 he became one of the original members of the staff of the Electronic Computer Project at the Institute for Advanced Study, Princeton. There he worked on the design and development of the large-scale, general purpose digital computer which later set the pattern for the construction of several "Princeton class machines." Dr. Ware joined The RAND Corporation in 1952, and is continuing work with digital machines.

FIELD TRIPS

There will be two field trips held in conjunction with the EJCC. Both are scheduled for Wednesday, December 2nd.

The first, an afternoon trip, will take delegates to M.I.T.'s Lincoln Laboratory (top picture), located about 16 miles west of Boston. Lincoln is at the research complex which includes Air Force Cambridge Research Center, Mitre Corporation, and a number of other defense-oriented plants. Lincoln, with 1600 employees, including more than 600 engineers and professional persons, is engaged in work on air defense systems for the North American content. The trip will feature an inspection and demonstration of the TX-2 computer being developed there. There will be a limit of 100 persons for the trip, and it is expected that only U.S. citizens may attend, because of security regulations.

The second trip will be made Wednesday evening to the Arthur D. Little plant (lower picture), in Cambridge. A. D. Little is one of the nation's foremost research organizations. The evening trip will include a demonstration of thin film Cryotrons which were developed at A. D. Little.

AWARD, SPEAKER

Two notable events will be held in conjunction with the dinner, concluding the conference on Thursday evening. The first will be the award presentation. We quote directly from the preliminary program, "In recognition of the fact that technical programs are sometimes marred by careless or obtuse presentation of papers, the EJCC has decided to emphasize the importance of a good oral presentation. An award of $300 will be made for the best presentation at the Conference of a paper describing significant work in the computer field. The winner of the award will be selected by the program committee and the presentation will be made at the Conference dinner on the last day of the meeting."

The second event will be an address by Dr. Willis W. Ware, of The RAND Corporation, on "Status of Computer Developments in the Soviet Union." Dr. Ware was a member of a delegation sent to Russia in May by the National Joint Computer Conference as part of an exchange arranged by the State Department. (Soviet computer experts visited the U.S. in April.) The American group visited a number of research institutes, universities, and computer factories—both users and producers of digital computers.

Dr. Ware will speak on the delegation's evaluation of the state of Soviet education, will tell of Russian programming projects, will evaluate the state of the industry in the USSR and will tell of personal contacts made. He will also discuss approximately a dozen Russian machines.

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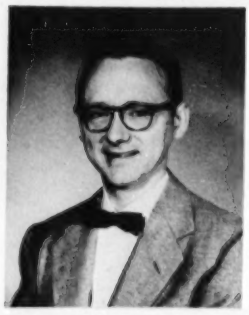

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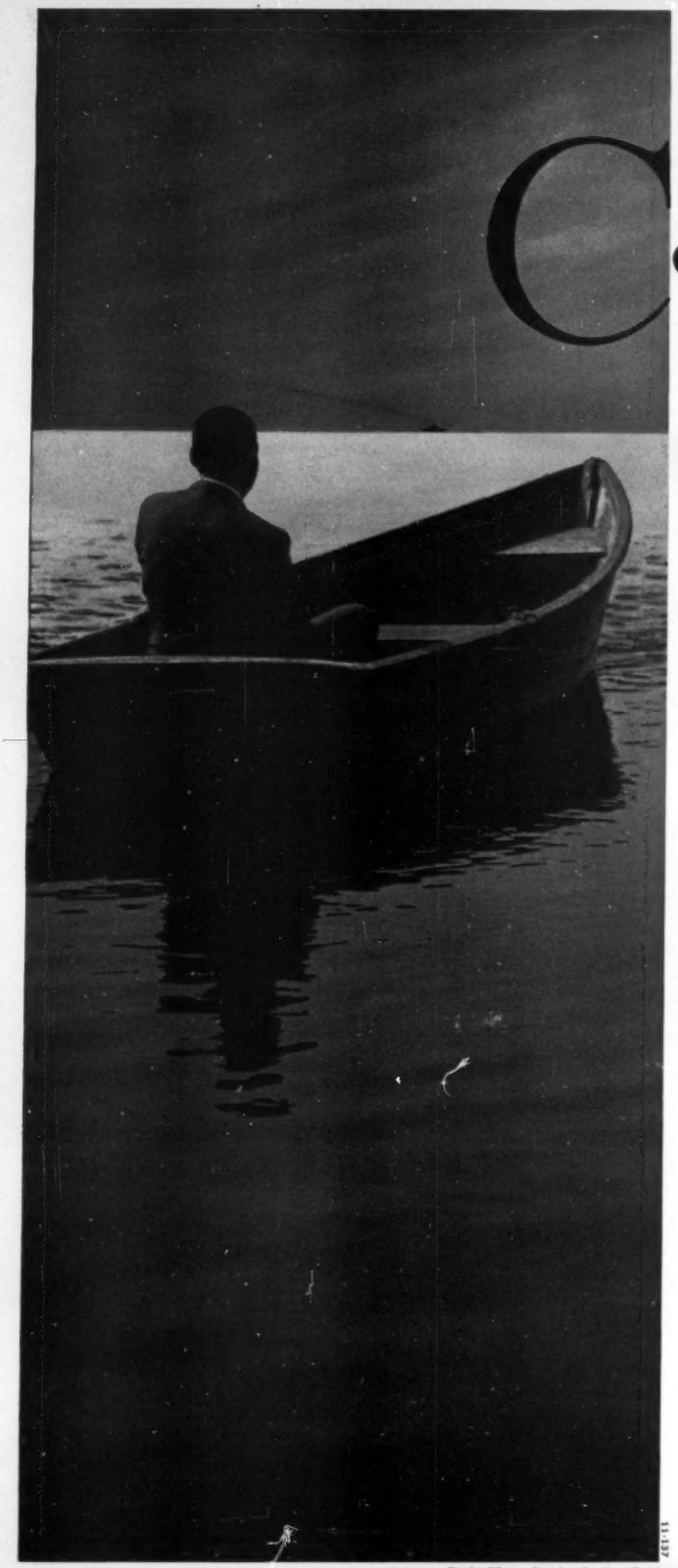

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"Project CLIP—The Design of a Compiler and Language for Information Processing," a paper by Harvey Bratman of SDC's Data Processing Research staff, is available upon request. Send request to Mr. Bratman at SDC.

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Ten years ago the professional organization of the computer field was just beginning. Only the real bit-niks dreamed of the universal interest, the tremendous growth, the cooperative enterprises, the excitement of the Fantastic Fifties. I was one of them, a far-out type, and it's been wonderful to help stage the even more ambitious spectaculars of our dramatic business.

We talked computers first. Then we called them data processors. And now the new OK phrase is information systems, or some such. Our current professional organizations are struggling to keep abreast; the smell, the ferment of change is in everyone's nostrils.

Clearly we have outgrown our early patterns. The hardware boys of the IRE and the AIEE committees, the technical applications youngsters of the ACM, have grown gray in the struggle (i.e., are now in their thirties), many other professional societies are deeply involved in "our" field, and entirely new outfits like SIAM and TIMS have appeared.

I propose to return again and again to this broad topic: how to organize ourselves to organize information. It will be a personal view, and a deeply felt one; I only wish I could buttonhole every reader and say, "It's time to do better; we **can** do better; let's talk it over!"

There is one immediate problem before the house: the ratification in some quasi-legal way of American participation in IFIP, the proposed International Federation of Information Processing (see page 21 for the draft constitution). The organizers and sponsors of the Federation are pushing hard for action this winter, so positive and negative comment is urgent.

In my view, there is one overwhelming reason why the IFIP charter should not be signed by the JCC (on behalf of its three components) or any other American professional body. I put aside such interesting questions as whether a federation is needed, whether its broad outline as a society of societies is sensible, whether financial support is possible, how international projects other than ICIP-type meetings – ALGOL, for instance – are to be handled. The major and immediate reason for objecting to IFIP is that it doesn't care about IP!

What is really happening is the old ACM yarn all over again. IFIP is really a federation of technical computation groups, and its European members are quite open about it. Business data processing, non-scientific-information retrieval, instrumentation and control – leave that to others; concentrate on numerical analysis, Turing machines, self-compiling compilers. Down with point-of-sale recorders, up with the heuristic algorithm!

I say it's spinach, and I say the devil with it! Information processing is as broad as our culture and as deep as interplanetary space. To allow narrow interests, pioneering though they may have been, to preempt the name, to relegate ninety percent of the field to "an exercise left to the reader," would be disastrous to the underlying unity of the new information sciences.

I came out of the scientific side: partial differential equations on the 601, harmonic analysis on the 407, orbit computations on relay calculators, lens design on the SSEC. But the dream is wider than to produce a slick matrix inversion routine or to stimulate a 205 on a 220. It's to remodel the whole world of the future with a tool unequalled for challenge since the invention of the alphabet, to amplify human intelligence by organizing and rationalizing the staggering flow of information that is the nervous system of society.

On the very threshold of what should be the Sapient, the Sagacious, the Sophisticated Sixties, let's not repeat the pattern of broad preemption and narrow performance that has troubled American information processing and hindered its spread. In the next year or two we shall certainly put our national house in order; then and only then can we rationally organize IFIP.

Herb

POTTER ANNOUNCES FAST MAGNETIC TAPE SYSTEM

Of interest to the entire automatic data handling industry was a news item released by Potter Instrument Company recently, wherein they announced their newly developed high density magnetic tape recording system. Outstanding features outlined by Potter include: (1) Transfer of data to or from the computer at rates in excess of 500,000 numbers per second; (2) Magnetic tape files reduced by a factor of 7 to 1; (3) Virtual elimination of errors in the data transfer from magnetic tape to computer. While details of the system are not being disclosed, the firm is maintaining a working demonstration of the system at their Plainview plant.

One of the principal achievements of the system is the ability to record and reproduce digital information at a pulse density of 1500 per inch.

The significant feature of the system, Potter states, is a seven times increase in data handling rate, accomplished with practically no errors. Several billion bits of recorded information were examined under purposely degraded conditions without one detectable error being found. Along with the overall advantage of speed is the fact that fewer tape reels for the file library are required with consequent reduced handling time.

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INTERCARD DEVELOPED FOR BENDIX BY N.A.

INTERCARD, a mnemonic, floating point interpreter-compiler, has been developed for the G-15 computer and CA-2 card coupler by Bendix Computer in collaboration with North American Aviation Missile Division. The complete system uses 3 MTA-2 magnetic tape units and standard card read and punch equipment. Thirty to forty commands are executed per second and input/output is at 100 cards read and 100 lines printed per second. The relative high speed of the system is made possible by a minimum access technique for commands and operations.

Circle 111 on Reader Service Card.

SDC DOUBLES NEW JERSEY FACILITIES AND PERSONNEL

Rapid growth is taking place at System Development Corporation's Paramus, New Jersey facility. The Corporation's Strategic Air Command Control System (SACCS) Division, now located in Lodi, will move part of its operation into a new building to be constructed in Paramus. The move will result in the Division doubling its facilities and personnel.

The new structure will house computer programmers who are working on the SACCS project and eventually employ 400 mathematicians, psychologists and engineers for SAC's giant, world-wide control system.

✓Plans for construction of a 32,000 sq. ft. computer component manufacturing plant on a 26-acre site at Santa Cruz were announced recently by Sylvania Electric Products, Inc. The Computer Products Operations of Sylvania Electronic Systems, have been operating in leased facilities in Santa Cruz since 1957. The Sylvania activities will transfer early in 1960.

✓Electronic Associates has recently completed a 60,000 sq. ft. extension of its West Long Branch plant. The new area houses 60 to 70 per cent of the production of the PACE 231R analog computer and support equipment. It also contains the production purchasing dept., the supporting production offices, and portions of Supply.

✓Control Data Corp. has recently announced that the Company's recent subscription offering of 99,594 shares of additional common stock has been substantially oversubscribed. Warrants were offered to stockholders on the basis of one share for each eight held, at a subscription rate of $12.00 per share.

✓Brown University has received a grant of $350,000 from the National

Science Foundation to be used for the purchase of an IBM 7070. Delivery of the near-million-dollar system is scheduled for mid-1960.

✓A lightweight digital computer for the Achiever all-inertial guidance for TITAN will be developed by IBM. A contract for the computer was awarded to IBM's Federal Systems Division facility at Owego, New York, by AC Spark Plug Division of General Motors in Milwaukee.

✓Three contracts have been awarded to Marc Shiowitz and Associates, Gardena, Calif. The contracts, all in the digital computer field, were awarded by Benson-Lehner, Litton Industries, and Norden Division, United Aircraft Corp.

✓The Norair Division of Northrop Corporation has announced the award of a contract approximating $400,000 to the Florida Division of Radiation, Inc., for a highly advanced PCM flight test data acquisition and data processing system.

✓Installation of a 40-ft Beckman analog computer was begun early in September at the Aero-Space division of Boeing Airplane Company, Seattle. The $225,000 EASE computer was acquired for study of the Bomarc missile and future advance missile and space vehicle systems. It will be used under the direction of Douglas R. Clifford, head of the mathematical services unit.

✓Minneapolis-Honeywell Regulator Company is building a second large-scale electronic data acquisition system for use in high-speed processing of rocket engine test information. It will be installed at the Bacchus, Utah rocket propellant plant of Hercules Powder Company.

✓Librascope, Inc. a subsidiary of General Precision Equipment Corp., New York, has established an Applied Research Department which will investigate new concepts in such advanced electronics fields as solid state physics. Wayne Blackburn has been named director of the new unit.

✓Semiconductor production facilities at Texas Instruments, currently being upped from 310,000 to more than 700,000 sq. ft., will make possible the mass production of new multipurpose transistors.

✓Fairchild Camera and Instrument Corp. revealed recently that it has purchased all the common stock of Fairchild Semiconductor Corp., Mountain View, Calif. The firm will expand production facilities from the present 68,000 sq. ft. to 183,000 sq. ft.

✓Ferranti-Packard Electric Limited, Toronto, has just been awarded a contract to design and manufacture a large digital computer for Trans-Canada Air Lines. The gp machine will be the center of a nationwide TCA reservation system, the field equipment for which is presently being built by Ferranti-Packard. The entire system will cost close to 3½ million dollars.

✓Douglas Aircraft has ordered an RW-300 from The Thompson-Ramo-Wooldridge Products Company. The computer, expected to be in operation in the Douglas plant in Santa Monica early next year, will exercise automatic closed-loop control over equipment used to test airborne servo systems.

✓The first Canadian installation of the Farrington reading machine will be made for Canadian Oil Companies, Limited, of Toronto. C.O. will be the ninth oil company in North America to use this equipment.

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DATA PROCESSING DIVISION

THE ROLE OF FIBER OPTICS IN DATA RECORDING

by DR. W. LEWIS HYDE

Assistant Director of Research, American Optical Co.
(From a paper given at the Symposium on Cathode Ray Tube Recording, Dayton, Ohio, January, 1959.)

A thin fiber of optical glass will transmit light from one end to the other with high efficiency, and a bundle of carefully arranged fibers will transmit an image. This art is called fiber optics, and we are studying it at the Research Center of American Optical Co.

Although the fibers can be made up in flexible bundles, they can also be cemented or fused. The purpose of this paper is to show that data recording from cathode-ray tubes may be easier and faster when the face of the cathode-ray tube is made of optical fibers fused together side by side so that each fiber runs perpendicular to the face of the tube from the inside surface to the outside.

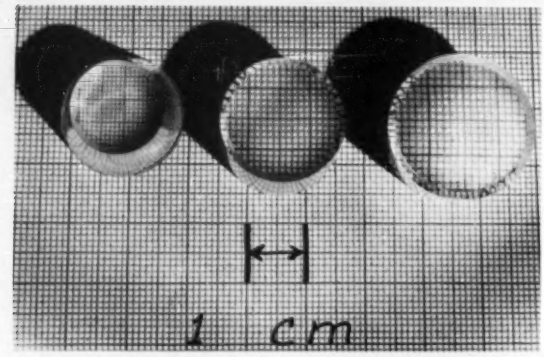

Figure 1. Each of the fused, vacuum-tight tube faces contains about 20,000 fibers. The samples on either side magnify and demagnify slightly.

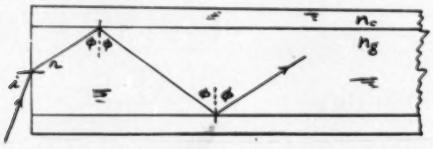

Figure 2. The ray of light shown is the steepest ray which can be trapped by reflection at the glass-to-glass boundary.

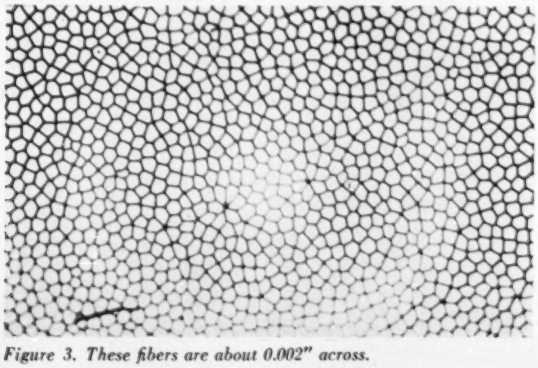

Figure 3. These fibers are about 0.002" across.

Each fiber can then pick up the light from the phosphor on the interior end and deliver it without parallax to a recording film close to the outer end. Such a tube face can be made with fibers less than .002 of an inch in diameter so that twenty or more lines per millimeter can be resolved. Figure 1 shows a sample of such material.

If the tube face were made of homogeneous glass fibers fused together, the fibers would lose their identity and the tube face would become an ordinary piece of glass. To avoid this we make each fiber of glass with a high index of refraction coated with a thin fused jacket of low index glass. In a typical case the index of the glass of the fiber is 1.75 and that of the jacket is 1.52. Let us now consider the optical efficiency of such a fiber so that we can compare it with a lens.

Figure 2 shows a meridional ray of light entering the end of a fiber whose index is n_g and whose jacket has an index n_c. As the ray approaches the wall we can find the critical angle for which total internal reflection just takes place by the relationship

$$n_g \sin \phi = n_c \sin 90^\circ = n_c$$

$$\text{or } \sin \phi = \frac{n_c}{n_g}$$

We can trace this ray back to its origin outside the fiber remembering that the angle r with respect to the end of the fiber is $(90^\circ - \phi)$ Then

$$\sin i = n_g \sin (90^\circ - \phi) = n_g \cos \phi$$

$$= n_g \sqrt{1 - \sin^2 \phi}$$

$$= n_g \sqrt{1 - \frac{n_c^2}{n_g^2}} = \sqrt{n_g^2 - n_c^2}$$

Sin i is the "numerical aperture" of a system in air, and the light-gathering efficiency of an optical system goes as the square of the numerical aperture. The numerical aperture of the 1.75 fiber with the 1.52 jacket is 0.86 and the half angle of the useful cone of light is 59°.

Now let us compare the optical efficiency of the fibers with the conventional method of recording the trace from an oscillograph with a camera. The phosphor throws out light in all directions (including backward) and a portion of this light is caught by the lens and focussed onto the film. The lens has a diameter, D, a focal length, f, and is being used to give a picture on the film the same size as

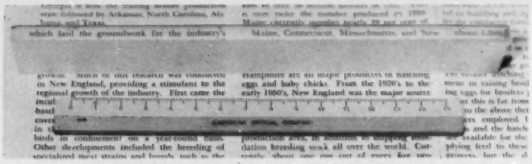

Figure 4. This tube face blank has about 700,000 fibers.

Figure 5. This bundle is demagnifying two-to-one. Such a bundle can be used to speed up a photographic lens.

that on the phosphor. The speed of a lens is defined as f/D and in a typical case of very fast lens, say f/1, the focal length will be equal to the diameter, but for unit magnification must be set back twice its focal length from the phosphor. It then catches a cone of light whose half angle is 14°, and the numerical aperture is 0.24.

To estimate the improvement in optical efficiency of fiber optics over an ordinary lens for transferring light from a phosphor to a photographic film, we take the square of the ratio of the numerical apertures, i.e. $(0.86/0.24)^2$ or about 13. We would therefore expect at least an order of magnitude improvement in optical efficiency; that is, a picture could be taken in one-tenth the time. In practice there are of course other considerations such as reflection losses in the lens, image quality at the edges of the field, directional emission from the phosphor, stray light, etc., but our friends who have built equipment with fiber optics tell us that they get an increase in speed of a factor of twenty and this seems quite reasonable from the above calculations.

Olden[1] has described a third solution to this problem, using a thin sheet of mica as a cathode-ray tube window. His scheme has much the same optical efficiency as that given by fiber optics, with somewhat less resolving power and a restricted useful area, since the mica must support atmospheric pressure.

Although a fiber optics tube face has superior optical efficiency for data recording, it is clear that optical efficiency is of secondary importance in many situations. If the data comes out at a reasonable rate, an ordinary photographic technique may be sufficient. We feel however that there are several circumstances under which fiber optics may be very important for data recording. The first is when very little light is available as may be the case at very high speeds. The second is when a great deal of data must be recorded and the cost and other characteristics of the recording medium are important. A factor of twenty in optical speed may make it possible to use some inexpensive or dry recording medium with lower optical efficiency than ordinary silver-halide emulsions.

When fiber optics are used the recording instrument has a very compact configuration. When a lens is used at unit magnification, the paper will always lie four times the focal length of the lens away from the cathode-ray tube, and when it is necessary to cover a large field, for instance recording letter type on pages eight inches wide, it may be necessary to have a lens 10″ or 12″ in diameter and put the photographic paper 3 or 4 feet away from the cathode-ray tube. With fiber optics all of this empty space is eliminated.

The resolving power of a fiber optics system is also very good, and uniform over the whole area. We commonly work with fibers 0.002″ in diameter, and can go smaller with new techniques now in the experimental stage, but 0.002″ is already at the limit of the resolving power of the human eye for ordinary reading distances.

One type of tube face that we are now making regularly is circular and about 1.5 inches in diameter. These are ordinarily made of fibers about 0.002 to 0.003″ in diameter with a jacket about 1/10 of the fiber diameter in thickness. Fibers are tightly but irregularly packed with the interesting result that the majority of them are five sided as shown in the Fig. 3. We can also make rectangular tube faces up to eight inches wide and one-fourth inch high, and one is shown in Fig. 4. Small quantities of these materials can now be obtained from American Optical Company on an experimental basis by companies and laboratories that are interested in getting some experiments started in this field. No regular commercial production is set up yet and prices are correspondingly high.

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[1] *Olden, R. G., RCA Review* 18, *343 (1957)*

new DATAMATION literature

TRANSISTORS: A concise two-page reference piece is complete with package photos, listing descriptions, important data and useful applications of five new silicon transistor developments. Included for additional reference is an itemized inventory with operating characteristics of a broad and complete line of available silicon transistors. For copy write TRANSITRON ELECTRONIC CORP., 168-182 Albion St., Wakefield, Mass., or use reader card.
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MAGNETIC MEMORIES: A four-page bulletin describes the series 3100 magnetic memories. Data linearization, nuclear spectrum analysis, card-tape processing and periodic crt display are a few of the many applications listed for the series 3100. Complete specifications and characteristics are also given. For copy write RESE ENGINEERING, INC., 731 Arch St., Philadelphia 6, Penna., or use card.
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MAGNETIC TAPE: A four-page illustrated bulletin describing magnetic tape for digital and analog recording includes performance qualities of the new tape, production techniques, and specifications. For copy write CONSOLIDATED ELECTRODYNAMICS CORP., 360 Sierra Madre Villa, Pasadena, Calif., or use reader card.
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PROCESSING APPLICATIONS: The wide range of data processing applications now being processed on a pay-as-you-go service bureau basis is indicated in a new brochure. Typical applications listed in the engineering fields include flutter analysis, reaction analysis, cut and fill, circuit analysis and design, and crude oil evaluation. For copy write THE SERVICE BUREAU CORP., 425 Park Ave., New York, N.Y., or use reader card.
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MEMORY CORE TESTER: Technical bulletin 59-A describes an automatic core tester, modular test system design approach, basic core test program, pulse programming, and the complete REACT system operation. The four-page bulletin also includes a block diagram of the core tester, complete specifications, and illustrations of components. For copy write RESE ENGINEERING, INC., 731 Arch St., Philadelphia 6, Penna., or use card.
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NEW LITERATURE

RECORD READERS: A new catalog defines the term "record reader" and discusses special purpose record readers which are used to convert information recorded in pictorial or graphic form into either digital or proportional analog resistance form. For copy write BENSON-LEHNER CORP., 11930 W. Olympic Blvd., Los Angeles 64, Calif., or use card.
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ANALOG COMPUTER: "Analog Computer CM-2," a two-page brochure describes and illustrates this solid-state computing device for mathematical calculations, especially applicable in the chemical, petrochemical, refining and process industries. It lists all technical data and specifications, including special amplifiers and networks which are available. For copy write SOUTHWESTERN INDUSTRIAL ELECTRONICS CO., 10201 Westheimer Rd., P.O. Box 22187, Houston 27, Texas.
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NPN TRANSISTORS: Technical data is now available on a comprehensive line of NPN transistors for high-speed switching and high frequency amplification. The line comprises 25 computer types suited for logic-circuit, core-driver, and other switching applications. For copy write CBS ELECTRONICS, 100 Endicott St., Danvers, Mass., or use reader card.
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DATA HANDLING CAPABILITIES: Bulletin 901 outlines the organization of the technical activities and describes how effective integration of the manufacturer's engineering sections covers the entire field of data acquisition, transfer, processing, and display. For copy write TELE-DYNAMICS INC., 5000 Parkside Ave., Philadelphia 31, Penna., or use card.
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ELECTRONIC TYPEWRITER: When to use edge-punched cards to expedite data-processing is the subject of a new, illustrated brochure. It also describes one of the latest advances in paperwork automation – the electronic Sychro-Tape typewriter. Although this equipment is equally efficient with either punched-tape or

edge-punched cards, it is the latter which the brochure emphasizes. For copy write REMINGTON RAND, 315 Park Ave. South, New York 10, N.Y., or use reader service card.
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CONSULTING FIRM: A 20-page, two-color brochure describes this firm's problem solving techniques. The reader will find information covering the following areas and more: "Mathematical and Statistical Services Division," "Sampling and Statistical Design," "Data Research Division," "Space Technology Division," "Management and Engineering Division" and "Computer Services Division." In all, 16 service areas are described. A floor plan of the data processing facility is included as are pictures of 37 of the firm's directors and technical staff members. For information write C-E-I-R, 734 15th St. N.W., Washington 5, D. C.
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ANALOG-TO-DIGITAL PROCESSOR: Details of MicroSADIC, a high-speed analog-to-digital processor, are presented in a new illustrated, four-page bulletin. Operation, design details and specifications are described. For copy write CONSOLIDATED ELECTRODYNAMICS CORP., 360 Sierra Madre Villa, Pasadena, Calif.
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TRIGISTOR: A new 16-page booklet covers some of the circuits and applications of the silicon trigistor. The booklet includes diagrams and information on how to achieve both significant miniaturization and higher reliability through circuit simplification. For copy write SOLID STATE PRODUCTS, INC., One Pingree St., Salem, Mass., or use reader card.
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ALPHA-NUMERIC PRINTER: Model 3260 high speed alpha-numeric printer is described and illustrated in a four-page brochure. A characteristic is the integration of a complete electronic storage and mechanical printer system into a single piece of equipment. For copy write POTTER INSTRUMENT CO., INC., Sunnyside Blvd., Plainview, L.I., New York.
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ANALOG COMPUTER: A new brochure, AC934, describes the PACE

NEW LITERATURE

TR-10, completely transistorized, portable analog computer. Accurate to 0.1%, it is capable of performing the mathematical operations required in the solution of 95% of routine engineering problems, according to the manufacturer. For copy write ELECTRONIC ASSOCIATES, INC., Long Branch, N.J., or use reader card.

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TRANSISTOR MANUAL: A new edition, the fourth, of the Transistor Manual contains 227-pages of completely re-written information on transistors and their use in electronic circuits. Included in the 20 chapters is information on basic semiconductor theory, transistor construction techniques, biasing, switching characteristics and several chapters on circuits. For copy send $1 to GENERAL ELECTRIC CO., Semiconductor Products Dept., Charles Building, Liverpool, New York.

TELEMETRY DECOMMUTATION: A new 8-page brochure "M-Series Ground Stations for PAM/PDM Decommutation" describes the various components of a ground decommutation system and how they operate. Basic, recommended systems layouts are given along with accessories that may be used with them. Specifications are provided. For copy write ASCOP, a division of Electro-Mechanical Research, Inc., Box 44, Princeton, N.J.

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INSTRUMENTATION RECORDER: A four-color brochure on the FR-600 instrumentation recorder which offers a frequency response to 250 KC in direct recording and to 20 KC in FM work is now available. Full specifications and descriptions of accessories, optional equipment, and "human engineering" design are included. For copy write AMPEX INSTRUMENTATION ADVERTISING, 934 Charter St., Redwood City, California.

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LOGIC CIRCUITS: Brochure No. 11959 gives details and specifications on transistorized logic circuits. These basic AND gates, OR gates, emitter followers and inverters are made in

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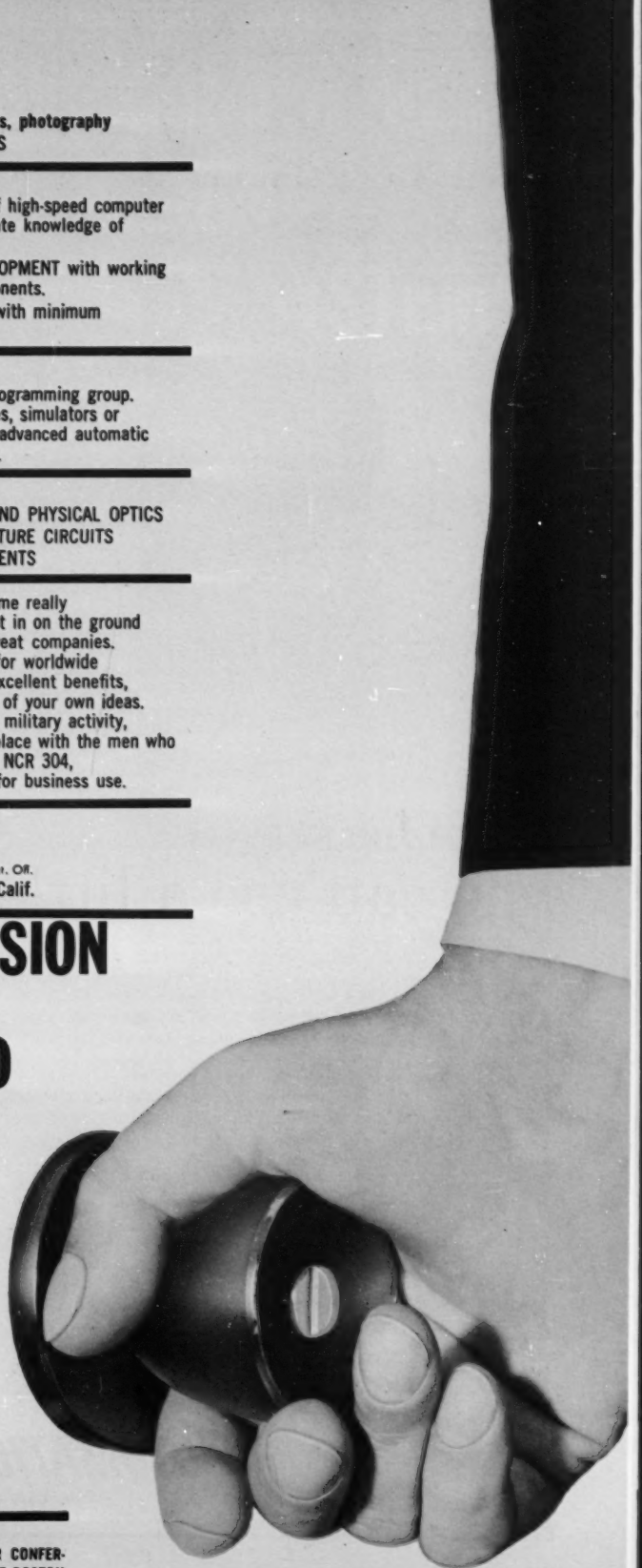

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FOR CONFIDENTIAL INTERVIEW DURING THE EASTERN JOINT COMPUTER CONFERENCE, CALL D. P. GILLESPIE, DIRECTOR OF INDUSTRIAL RELATIONS AT THE BOSTON STATLER HILTON, HANCOCK 6-2000.

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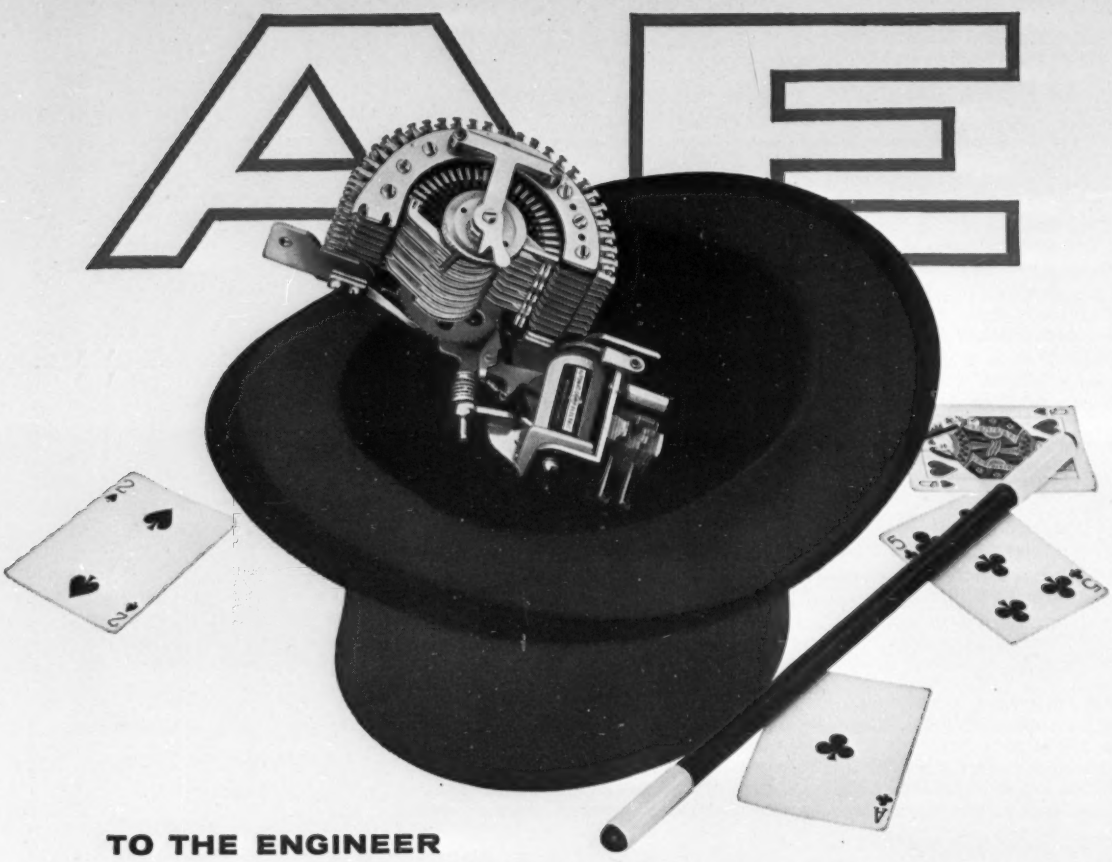

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ANALOG COMPUTERS: An Air Force report just released claims that analog computers can unravel problems of flame and fluid dynamics unsolvable by other means but are not widely used because chemists aren't aware of their capabilities in those fields. Application of Analog Computers to Various Combustion, Flame, and Fluid Dynamics Problems (PB 151775). For copy send $1.75 to OTS, U.S. DEPARTMENT OF COMMERCE, Washington 25, D. C.

ELECTRODEPOSITION: An electrodeposition technique and another involving thermal decomposition of acetyl acetonate can produce thin nickel-iron alloy films with a variety of compositions, thicknesses, and magnetic properties, Air Force research has disclosed. A final report of the study of ferromagnetic films has been released. The Preparation and Characteristics of Thin Ferromagnetic Films (PB 151525). For copy send $2.75 to OTS, U.S. DEPARTMENT OF COMMERCE, Washington 25, District of Columbia.

MAGNACARD TECHNIQUES: Development of the Magnacard system, a technique for high-speed handling of magnetic cards expected by its developers to open a "whole new technology" in data processing, is described in an Air Force report. "Research and Development of the Magnacard System" (PB 151828). For copy send $3 to OTS, U.S. DEPARTMENT OF COMMERCE, Washington 25, District of Columbia.

AUTOMATION PROCEEDINGS: Proceedings of the Life Office Management Association's Automation Forum, a 416-page book containing a record of the April 13-15 meeting, includes transcripts of "A Constructive Auditing Approach Toward Electronic Data Processing," and "Can The Contemporary Executive Cope With The Computer Challenge." For copy send $8.25 ($5.25 to members) to L.O.M.A., 110 East 42nd St., New York 17, N.Y.

NON-LINEAR PRODUCING OTRAC

A new oscillogram trace reader, a semi-automatic data reduction machine for handling oscillographic data, is currently being produced (and delivered) by Non-Linear Systems, Inc., it was recently announced.

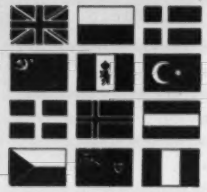
Model 12 OTRAC will semi-automatically convert oscillogram traces into the digital perameters to which the traces correspond. After conversion, the data are automatically tabulated on an electric typewriter or are fed into tape or card punches. Up to ten channels of data can be handled at once.

Using the transistorized Model 20 Series digital voltmeter for analog to digital conversion, and the new Model 264 transistorized serial converter for driving typewriters or punches, NLS state that OTRAC introduces an advance in reliability into the oscillogram reader field. The system resolves 1800 counts per inch. The optigraphic reading head reduces separation of the reading cross hair 0.010 inch with negligible parallax error and permits inserting non-linear trace calibrations into the system.

Convenience and accuracy in reading X-axis data is achieved by a dual measuring system. Reading can be either incrementally from the time lines printed on oscillograms, or by actually measuring X-axis displacement. The displacement measuring method is preferred where transient data must be read or where data must be read at random time increments or at increments smaller than those provided by the timing lines. To set up the instrument, an operator turns the individual zero point and scale factor controls provided for each channel, until the proper reading occurs on the digital readout. To reduce the oscillographic data, the operator lines up the reading head cross hair with the trace to be read and pushes a button. The analog to digital conversion is completed in one-third second and the operator can immediately remove the cross hair to the next trace to be read.

Data loading and unloading has been simplified through the use of collapsible spools and a data transport system that pivots completely away from the reading area. The collapsible spools enable data to be removed at any time and later reinstalled.

Circle 108 on Reader Service Card.



DATAMATION abroad

WEGEMATIC 1000 SET FOR WEIZMANN INSTITUTE

Israel's Weizmann Institute of Science, at Rehovot, will be presented with a Wegematic 1000 computer early in 1960. Donors are Leo Hirsch, a Los Angeles auto dealer, and Dr. Axel Werner-Gren, Swedish financier. The Wegematic 1000 is a Swedish engineered improvement of the Alwac 3E and the Weizmann machine will mark the second delivery. The first delivery was made in January to Gevaert of Belgium, a film equipment company.

ALGOL GROUP TO PUBLISH FINDINGS IN '60

DATAMATION's European Editor was informed by a reliable source that the group preparing ALGOL is scheduled to pause in its progress on September 1960 and publish its findings to that date. The published information will be available to all prospective users.

ICCPC SYMPOSIUM PLANNED EARLY NEXT YEAR

Result of a meeting of the International Computation Center's Preparatory Committee was an agreement that a Symposium would be convened in 1960. This may take place during the summer, in collaboration with CIME, an Italian organization which proposes to organize a mathematical seminar in Varenna. The Symposium will deal with two subjects: the numerical treatment of normal differential equations; and the numerical treatment of integral and integral differential equations. Representatives of Mexico, Spain and the United Arab Republic made known their interest in data processing equipment involved in the design of dams and problems of irrigation for arid countries.

FIRST EDITION OF IP GLOSSARY PUBLISHED

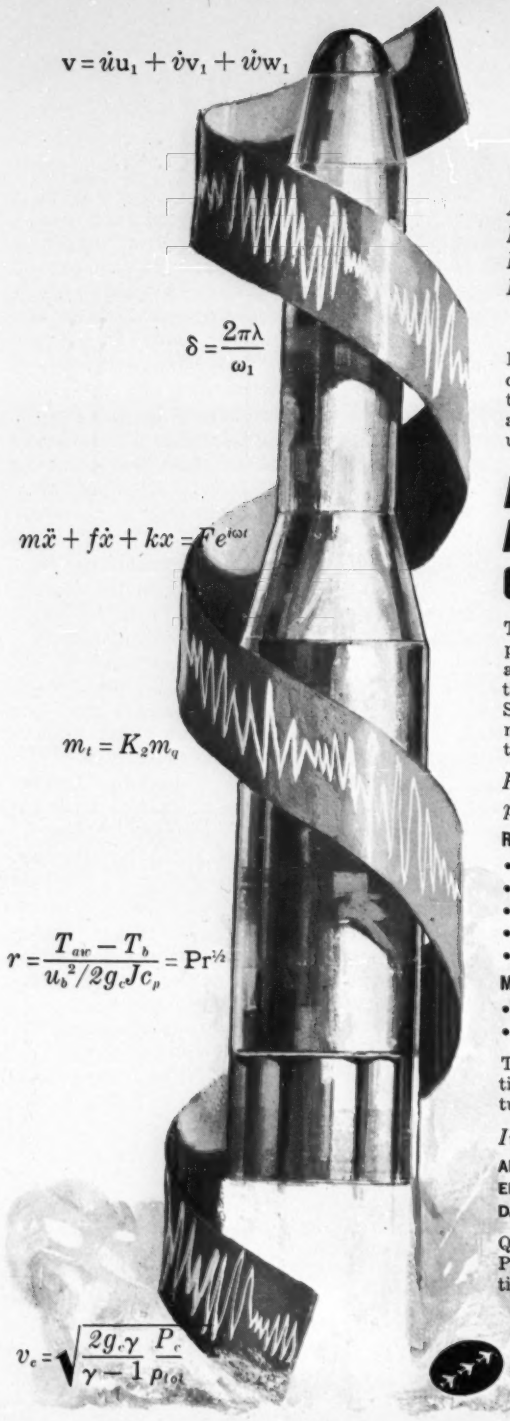
The first provisional edition of a multilingual terminology of information processing has recently been compiled by Dr. J. E. Holmstrom, for the International Provisional Center. Contributions have been made by experts from computing centers in Russia, Mexico, France, and Germany, in their respective languages; experts in England, Canada and the USA contributed differences in English language terminology. Work will proceed in this area and other languages will be added -- such as the differences in terminology of Spain and Latin America.

GAMMA 60 LANGUAGE, A.P. 3 DEVELOPED

A new language, known as A.P.3, said to compare with the universal mathematical language, has been developed by Mrs. J. Poyen, for use with Bull Machines' Gamma 60 computer. A.P.3 uses alphabetic characters, arabic numerals, and usual mathematical signs and punctuation marks, and is an automatic programming of algebraic type intended for writing scientific problems.

PUERTO RICO GETS 705 DP CENTER

The Puerto Rican Government announced they have installed the largest electronic data processing center of its kind in Latin America. A 705 forms the heart of the center. Prime use of the center will be to handle the payroll for 36,000 government personnel and the planning of road building programs.



Applied Mathematicians
Engineering Programmer Analysts
Programming Techniques Specialists
Data Processing Programmer Analysts

Republic Aviation's newly organized Computer Division, centralizes in one group all company-wide computer activities related both to diversified Aero-Space R & D programs and Management Data Processing Applications. It provides unusual opportunities to...

ADVANCE COMPUTER APPLICATIONS TECHNIQUES CONCEPTUALLY AND IN PRACTICE

The outputs of the largest, fastest, most advanced computers are no "wiser" than the inputs devised by creative analysts and scientists. This fact is never lost sight of by the technical leaders of Republic's new Computer Division. Sustained effort is directed toward the goal of developing new mathematical and programming techniques to extend the state of the art in large scale computer applications.

Programs in which the Division participates include:

Research & Development

- Interplanetary Trajectory Studies
- Computer Simulation Investigation
- Plasma Propulsion Studies
- Space Environment Investigations
- Nuclear Studies

Management Projects

- Inventory Control
- Payroll Applications
- Drawing Control
- Operations Analysis

To implement these programs, an IBM 704 is now in operation and a 7090 is scheduled for installation in the near future. Other sophisticated data processing tools are available.

Immediate openings in:

APPLIED MATHEMATICS • PROGRAMMING TECHNIQUES
ENGINEERING-SCIENTIFIC PROGRAMMING ANALYSIS
DATA PROCESSING PROGRAMMING ANALYSIS

QUALIFICATIONS: BS, MS or PhD in Engineering, Physics, Mathematics, Statistics or Business Administration. 2 years experience in computer field desired.

Send resume in confidence to: Mr. George R. Hickman
Technical Employment Manager —Dept. 32M

REPUBLIC AVIATION

Farmingdale, Long Island, New York

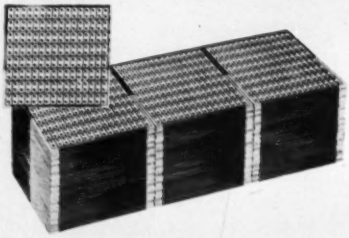
computer diodes
This manufacturer is placing in inventory for immediate delivery nine JAN type subminiature diodes in silicon and germanium. These include types 1N457, 1N458 and 1N459 in silicon, and types 1N128, 1N198, 1N270, 1N276, 1N277 and 1N281 in germanium. Details concerning these high-reliability computer type diodes is contained in bulletin B-217A-2 (silicon) and bulletins B-213-1 and B-213-2 (germanium). For information write CLEVITE TRANSISTOR PRODUCTS, A Div. of Clevite Corp., 241 Crescent St., Waltham 54, Mass.
Circle 200 on Reader Service Card.

analog computer
The smallest analog computer now available – a 10-amplifier model weighing just 23 pounds – is now in

production. Designed for educators, engineers and scientists, Model 3500 can be used to study almost any physical system that can be described by linear differential equations. The standard, 10-amplifier 3500 will solve up to a seventh order differential equation or a ninth degree Laplace transform. For solving more complex problems, up to three Model 3500 computers can be slaved together for 10, 20, or 30 amplifier operation. For information write DONNER SCIENTIFIC CO., Concord, Calif.
Circle 201 on Reader Service Card.

tape programmer
A militarized perforated tape programmer, Model 3277, is now available for use in military check-out systems. Designed and built to conform to MIL-E-16400, the programmer features bi-directional drive, character reading rates up to 200 per second, tape widths up to one inch, and self contained electronics for control and data playback. For information write POTTER INSTRUMENT CO., INC., Sunnyside Blvd., Plainview, N.Y.
Circle 202 on Reader Service Card.

memory stacks
Series 3000 apertured ferrite plate memory stacks, a line of miniature magnetic storage plug-in modules, for



use in high speed random access memories and serial buffers, are available in standard sizes from 256 to 4096 words and 4 to 16 bits per word, and can be supplied in a wide variety of special address capacities and word lengths. Particularly suitable for use in miniaturized equipment, their compact construction (2½ in. x 3⅜ in. x 3⅜ in. for the 512 word, 8 bit module) is achieved through the use of the 0.87″ square apertured ferrite plate as the storage medium. Operating in the same coincident-current selection scheme as conventional core arrays, the plates require 150 milliamperes for half excitation. For information write RESE ENGINEERING, INC., 731 Arch Street, Philadelphia 6, Penna., or use reader service card.
Circle 203 on Reader Service Card.

transistorized modules
A series of transistorized, digital, plug-in circuits features in-put and out-put buffering. Built-in buffering allows engineers to go directly from logic diagrams to circuitry. The mod-

ule series includes all functions normally encountered in digital systems and computer applications. Modules for binary and linear counter stages, pulse shapers, pulse generators, multiple coincidence gate, and relay and neon drivers are provided as shelf items. Special circuits are available. For information write VITRO LABORATORIES, 200 Pleasant Valley Way, West Orange, N.J., or use card.

Circle 204 on Reader Service Card.

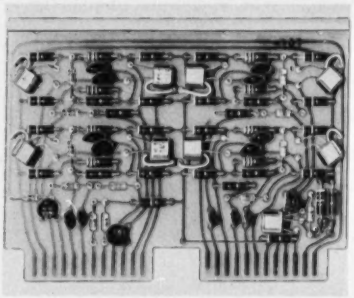
digital plotter

Model GP-1 digital plotter consists of (1) two high-speed servo systems which position a printing mechanism according to the binary coded X and Y input signals, (2) two digital-to-analog converters, one each for the X and Y signals, (3) a plot and computer acknowledge circuit and (4) power supplies. The plot and computer acknowledge circuit actuates the printing solenoids after the printing mechanism has been properly positioned by both the X and Y servo systems. The Model GP-1 digital plotter can be supplied to accept X-Y data in any normally used digital format. For information write THE GERBER SCIENTIFIC INSTRUMENT COMPANY, 89 Spruce St., Hartford, Conn.

Circle 205 on Reader Service Card.

digital module

Binary decade counter, Model BD-101 consists of four transistor flip-flops that may be externally connected



as a binary counter, as a binary coded decimal counter, or other multistage counter that requires feedback. Power required for the counter is +20 volts at 20 milliamperes and −90 volts at 1 milliampere. For information write COMPUTER CONTROL COMPANY, INC., 983 Concord St., Framingham, Mass., or use reader service card.

Circle 206 on Reader Service Card.

data processing system

Elements of the basic 1401 system are the 1401 processing unit, 1402 card read-punch, and 1403 printer.

Configurations include a card system, a tape system and a combination of the two. The 1401 may be operated as an independent system, in conjunction with punched card equipment, or as auxiliary equipment to larger systems. It performs functions previously requiring a number of separate machines: card reading and punching, separation of output cards, calculating and printing.

processing unit – The 1401 performs arithmetic and logical functions, controls card reading-punching, and magnetic tape input and output and instructs printer. It edits systems printed output and is available with 1,400, 2,000 and 4,000 positions of core storage. It processes both alphabetical or numerical data.

card read-punch – The 1402 reads card information into the processing unit, punches cards and separates them into radial stackers. Cards can be removed during operation. Maximum speeds are 250 cpm punching, 800 cpm reading.

printer – The 1403 has a moving horizontal chain of engraved type faces operated by 132 electronically-timed hammers spaced along the printing line. The impact of the hammer presses the paper and ink ribbon against a type character, causing it to print. A printer feature, Dual Speed Carriage, allows it to skip over blank spaces on forms at speeds in excess of normal printing rate. For information write INTERNATIONAL BUSINESS MACHINES CORP., 112 E. Post Road, White Plains, N.Y., or use reader service card.

Circle 207 on Reader Service Card.

tape preparation, editing

A new paper tape preparation and editing console which automatically verifies and duplicates tapes consists

of a numerical keyboard, a control and comparison section with 6-digit decimal readout, two tape readers and one tape perforator. Key features are tape-to-tape duplication and verification at 60 characters per second; keyboard visual display and shift register to eliminate copying errors; automatic error alarm and tape corrections without over punching or splicing. Tape may be produced in several modes from source data entered at the keyboard. Or it may be reproduced directly from a master tape placed in one of the readers. For information write TALLY REGISTER CORP., 5300 14th Avenue N.W., Seattle 7, Wash., or use reader service card.

Circle 208 on Reader Service Card.

logic circuit plug-ins

Series 2010 Logix Blocks are a set of transistor operated, digital logic circuit plug-in cards, for design and construction of special purpose digital computers and data processing equipment, digital communication links, digital simulation, and related equipment. Operating at data rates in the 200 kc range, Logix Blocks feature end point circuit design. The circuits, which include flip-flops, gating circuits, pulse generators, power amplifiers and multivibrators, operate over a temperature range of from −30°C to +55°C, and are mounted on glass-epoxy base material. For information write RESE ENGINEERING, INC., 731 Arch St., Philadelphia 6, Pa.

Circle 209 on Reader Service Card.

tape interrogator

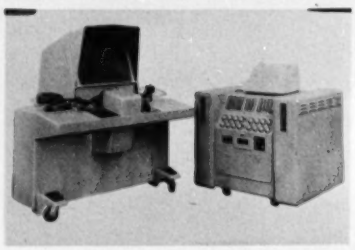
The Univac tape searchwriter, an integrated system which provides an economical method of searching a magnetic tape file for a desired item and then automatically types the in-

formation, has just been announced. Users of Univac II computing systems will find it particularly valuable as peripheral equipment. It permits finding tape-recorded records and printing the desired information without consuming computer or programmer time. It may also be used as an error-checking interrogator because it incorporates all the error-checking features found in Univac systems. For information write REMINGTON RAND UNIVAC, 315 Park Avenue South, New York 10, N.Y., or use card.

Circle 210 on Reader Service Card.

film reading system

Dilog 510, a new semi-automatic film reader with an automatic, high speed electronic digitizing unit accurately



measures distances along two axes on 16mm to 70mm sprocketted film and displays a magnified image of the film being measured. The digitizer is an indicating and recording accumulator which counts and stores measurement pulses generated by the reader. The 510 has a counting rate of 20,000 counts per second with a maximum storage 100,000 counts along each axis. Card punching speed is 50 cards per minute; will also type up to 600 characters per minute, or will provide 20 columns per second of punched tape with optional output equipment. For information write DATA INSTRUMENTS, A Div. of Telecomputing Corp., 12838 Saticoy St., North Hollywood, Calif., or use card.

Circle 211 on Reader Service Card.

recording system

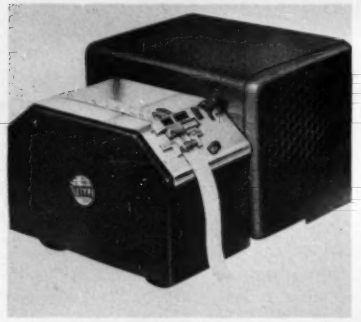
The development of a high-speed recording system, Dacom, that reads magnetic tapes from computers and registers characters on microfilm has been announced. Dacom has a speed of 16,500 characters per second. As many as 66 lines of 130 characters can appear as a page, and these are microfilmed at more than two frames per second. The system can record 6,900

lines or more per minute. A roll of 1,000 feet of 16mm film will contain the decoded information from more than 35 reels of 2,400-foot magnetic tape. With the new system a vast amount of information can be recorded, ready for storage, viewing, or reproduction. Dacom will have varied applications in high-speed computer read-out, and in other fields under study. For information write KODAK APPARATUS & OPTICAL DIVISION, 343 State Street, Rochester 4, N.Y., or use reader service card.

Circle 212 on Reader Service Card.

tape reader set

Model 28 miniaturized LXD tape reader set measures 5⅞ in. in height, 7½ in. in width and 9½ in. in depth



and features facilities for sequential (serial) output, hundred-word-per-minute transmission and reduced power requirements. Optional contacts are available for multiwire output. Models may be had to read 5- or 6-level chadless or fully perforated tape. The new set is proposed for a wide range of tape reading applications including on-line data transmission over existing communications facilities. For information write TELETYPE CORPORATION, 4100 Fullerton Avenue, Chicago 39, Illinois, or use card.

Circle 213 on Reader Service Card.

micro micro diode

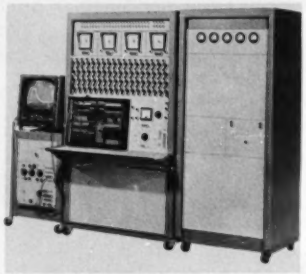
This tiny device designed for computer and missile manufacturers and others in the electronics industry weighs 14.09 milligrams compared with 160 milligrams for a silicon diode considered standard. Production of the diode involves chemical bonding of the molecules of the silicon crystal with surface elements that serve as a protective coating. The process is termed a chemical surface passivitation technique. Ordinarily, functioning diode or transistor crystals are encapsulated in glass containers. The new bonding is described as one

of the secrets of the size reduction. The manufacturer states that 20,400,000 of these diodes could fit in a cubic foot of space. The device is now in full production. For information write PACIFIC SEMICONDUCTORS, INC., 10451 W. Jefferson Blvd., Culver City, Calif., or use card.

Circle 214 on Reader Service Card.

analog computer

All logic elements in DYSTAC (DYnamic memory and Storage Analog Computer) operate with a frequency



response adequate for 50 solutions per second. The dynamic memory element stores input variables within ±10 microseconds of automatic HOLD command and resets in one millisecond. An interpolator provides single-variable function generation with fourth-order accuracy from five input data points. The basic DYSTAC is available with 48 amplifiers, field-expandable to 80 operational amplifiers; larger DYSTAC systems are equipped with 222 operational amplifiers, 90 electronic multipliers, and 30 ten-segment diode function generators. For information write COMPUTER SYSTEMS, INC., 611 Broadway, New York 12, N.Y., or use card.

Circle 215 on Reader Service Card.

trice, daft

TRICE (Transistorized Realtime Incremental Computer Expandable) directly replaces analog computers for simulation and other purposes. As a part of an operational system, it can perform as a missile impact predictor, a process control optimizer, a satellite tracking computer, a stable platform computer, a generalized coordinate converter, and for similar high speed computations. DAFT (Digital/Analog Function Table) provides accurate and repeatable arbitrary function generation for analog computers. Arbitrary functions – such as drag as a

function of speed – are often critical in analog computations. By increasing the accuracy and repeatability with which such functions can be generated, overall analog solution accuracies often can be increased by one or more orders of magnitude. For information write PACKARD BELL ELECTRONICS CORP., Technical Products Div., 12333 W. Olympic Blvd., Los Angeles 64, California.

Circle 216 on Reader Service Card.

scanning printer

A new solenoid-actuated, self-contained scanning printer is designed to print data from high impedance decimal sources. Operating on a minimum +10 volt DC input signal, the Digit-Matic scanning printer scans and prints numbers stored in glow counter tubes, digital ohmmeters, Nixie display counters, or other electronic devices. This printer may be adapted to perform functions from listing to addition and subtraction, multiplication and division. It can be furnished with various model adaptions and digital capacities. The normal operating speed is .250 seconds per column scanned. An additional .270 seconds is added with non-totalizing printers and .350 with totalizing models. For information write VICTOR ADDING MACHINE CO., 3900 N. Rockwell St., Chicago 18, Ill., or use card.

Circle 217 on Reader Service Card.

midget data logger

A midget digital data logger, weighing two ounces, and capable of continuously monitoring up to ten channels of information in a tactical telemetry system, will be delivered shortly to the Navy Bureau of Aeronautics. The logger, an outgrowth of research and development of commercial digital data processing equipment, occupies 2½ cubic inches and, with its accompanying battery and transmitter, fits into a flip-top cigarette package. For information write AERONCA MANUFACTURING CORP., Middletown, Ohio, or use reader card.

Circle 218 on Reader Service Card.

selenium diodes

Capable of operating in ambient temperatures from −50°C. to +100°C. without derating, the selenium diodes come in eight types, wtih peak inverse voltage ranges from 50 to 400 volts, at 12.5 ma. Maximum case length is .380 inches for all eight types, with

widths ranging from .340 inches for the 50 and 100 volt units up to .480 inches for the 400 volt type. Bent pigtail and red dot on body of the diode give positive lead indication. Applications cover a wide range from computers, business machines, power supplies, etc. For information write RADIO RECEPTOR COMPANY, 240 Wythe Ave., Brooklyn 11, N.Y.
Circle 219 on Reader Service Card.

registered printing

S-C 5200 Systems print numbers, letters or symbols at speeds up to 5,000 lines per minute on pre-printed forms. They incorporate several changes from the original S-C 5000 Series to permit printing of pre-printed forms with close tolerance. These include an M-30 Storage Buffer which stores and interprets data and instructions from digital computers and directs the printing format. The S-C 5200 Systems include circuitry for photosensing registration marks and for controlling start-stop, skipping, end of line, end of file and stop, parity check and parity check alarms, and end of record. The M-30 uses a magnetic core to store data and release it at the correct printing rate. For information write STROMBERG-CARLSON-SAN DIEGO, Div. of General Dynamics Corp., Box 2449, San Diego 12, Calif., or use reader service card.
Circle 220 on Reader Service Card.

recovery diodes

New diode types combining high current capabilities with exceptionally fast recovery times for ideal application to computer switching operations are now in production. The new silicon-diode types, 1N837 through 1N845, generally follow the specifications of the widely used family of diodes represented by type 1N643. However, the forward current capability has been sharply increased, by a factor of 10-1 or better in most cases. The minimum forward-current specification for the new diodes (at 25°C and 1.0 volt) is 100 to 200 mA. These units stay within a maximum recovery time of 0.3 to 0.5 microseconds. For information write HUGHES AIRCRAFT COMPANY, Florence Ave. & Teale St., Culver City, Calif
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Since this ad first appeared on June 16th 1959 43 engineers have joined HMED – and there are approx. 38 positions at all levels open now!

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General Electric's Heavy Military Electronics Dept.

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VERSATILE AIR CONTROL APPLICATIONS The revolutionary 412L can be used to defend a single airfield, or, by linking control sites together, it could be used in a limited action to provide air control for an area the size of Alaska. Similarly, by linking the capabilities of countries together, a system could be provided for the air control of an entire continent. Designed for both fixed and mobile applications, the 412L will be used primarily outside the U. S. since the SAGE system is used for the defense of this country.

HMED IS ALSO DESIGNING THE "HEART" OF THE SYSTEM In addition to its prime mission of providing systems management, HMED will design, develop and produce the data processing and display subsystem which is the "heart" of the 412L. Capable of rapidly and automatically detecting and tracking air targets, the subsystem operates without human assistance, except under unusual circumstances.

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- Fixed & Mobile Radar
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- Underwater Detection Systems
- Missile Guidance
- Data Handling Systems
- Communications

Individuals with experience in systems analysis or specific equipment design in the areas listed above are invited to forward their resume in complete confidence to Mr. George Callender, Div. 00.

HEAVY MILITARY ELECTRONICS DEPARTMENT

GENERAL ELECTRIC

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Write today or call me collect at GR 6-4411, Ext. 7830 George Callender

Expanding the Frontiers of Space Technology in

COMPUTER OPERATIONS

■ Lockheed Missiles and Space Division's computer center is one of the largest and most modern in the world. It is concerned with formula and data applications in more than 40 areas of science and technology.

Equipment includes two Univac 1103AF digital computers with twenty magnetic-tape units, card-to-tape and tape-to-card converters, and two high-speed magnetic tape printers; two IBM 709 digital computers with two data synchronizers, twenty-four magnetic-tape units, CRT display and recorder units, card-to-tape and tape-to-card converters, two high speed and one low speed printers; four Lockheed magnetic-tape plotters, Model 1100 variplotter; three 100-amplifier, three 60-amplifier, and two 20-amplifier analog computers; twelve 11″ x 17″ X-Y plotters; double-arm 30″ x 30″ X-Y plotter; and 114 channels of time-history recorders.

The center serves both government and industry in the solution of complex mathematical problems. Digital computer programs have been used in such work as: strategy and logistics; stress and flutter analysis; static, wind-tunnel and flight testing; missile performance; aerodynamics; trajectory computations; financial forecasting; personnel assignments; cost accounting; control-systems analysis; and various problems involving numerical integration, simulation, curve fitting and numerical approximations. Work with analog computers includes the solution of problems in flight control stability; structural analysis; dynamic analysis; and simulation.

ENGINEERS and SCIENTISTS

Lockheed's programs reach far into the future and deal with unknown and stimulating environments. If you are experienced in one of the above areas, or in related work, we invite you to share in the progress of a company that has an outstanding record of achievement and make an important individual contribution to your nation's efforts in the race for space. Write: Research and Development Staff, Dept. L-46, 962 W. El Camino Real, Sunnyvale, California. U.S. citizenship required.

Lockheed

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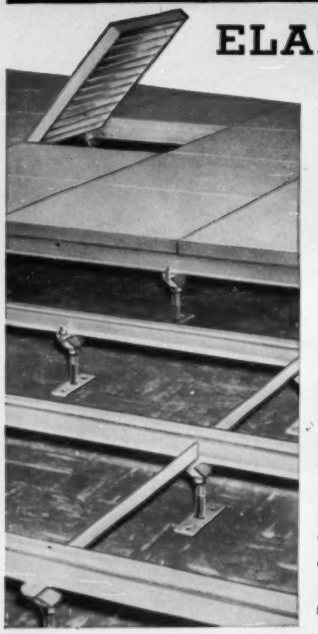
elevated aluminum flooring



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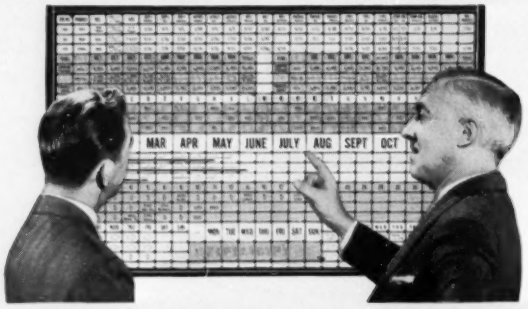
How To Get Things Done



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ST. PAUL FIRM ANNOUNCES

COMPUTER DISPLAYS

Two new output display devices which have attracted the attention of at least two major computer manufacturers (Control Data Corp. and Remington Rand) have been announced by Data Display, Inc., 1820 Como Ave., St. Paul, Minn. The two units are dd52 and dd37.

The dd37 is a computer output display device useful for realtime data monitoring, computer maintenance testing and computer program debugging. Data is displayed on conventional cathode ray tubes. Deflection signals which form the numerals, letters and other symbols are developed by an application of digital circuit techniques resulting in high operating speed. The character repertoire is the octanary set of Arabic numerals, zero through seven. Any numeral may be displayed at any position in 32 vertical columns and 32 horizontal rows. A maximum of 1,024 characters can be displayed simultaneously. A 14 bit (minimum length) computer output register is used for data transmission to the dd37. Some specifications are: 200,000 char/sec. data display rate; 2½ microseconds character generation time, and input enable resync time. The dd37 can be adapted for use with any computer.

The dd52 is a high speed computer output display which can display a full set of alphanumeric characters. The 48 character repertoire is the decimal numerals, the English alphabet and miscellaneous marks and signs. Any symbol can be displayed at any position in 1,024 vertical columns (512 columns on each of two cathode ray tubes) and 512 horizontal rows. A maximum of 4,100 (approximately) characters can be simultaneously displayed. A 26 bit computer output register is used for data transmission. Some features are: 8 microseconds total time between successive character displays; 125,000 char/sec. data display rate; character regeneration rate of 30 per second minimum flickerless presentation.

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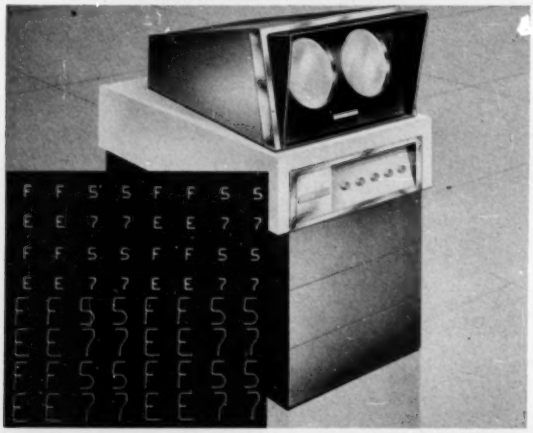

The dd52 and (inset) a typical display on an engineering prototype five-inch cathode ray tube. The characters shown are being displayed at a 200 kc rate (i.e., an average of five microseconds between successive characters).

ADVERTISERS' INDEX

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43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
100	101	102	103	104	105	106	107	108	109	110	111	112	113	114						
115	116	117	118	119	120	121	122	123	124	125	126	127	128	129						
130	131	132	133	134	135	136	137	138	139	140	141	142	143	144						
145	146	147	148	149	150	151	152	153	154	155	156	157	158	159						
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230	231	232	233	234	235	236	237	238	239	240	241	242	243	244						
245	246	247	248	249	250	251	252	253	254	255	256	257	258	259						
260	261	262	263	264	265	266	267	268	269	270	271	272	273	274						
275	276	277	278	279	280	281	282	283	284	285	286	287	288	289						
290	291	292	293	294	295	296	297	298	299	300	301	302	303	304						

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72	78	84	90
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74	80	86	92
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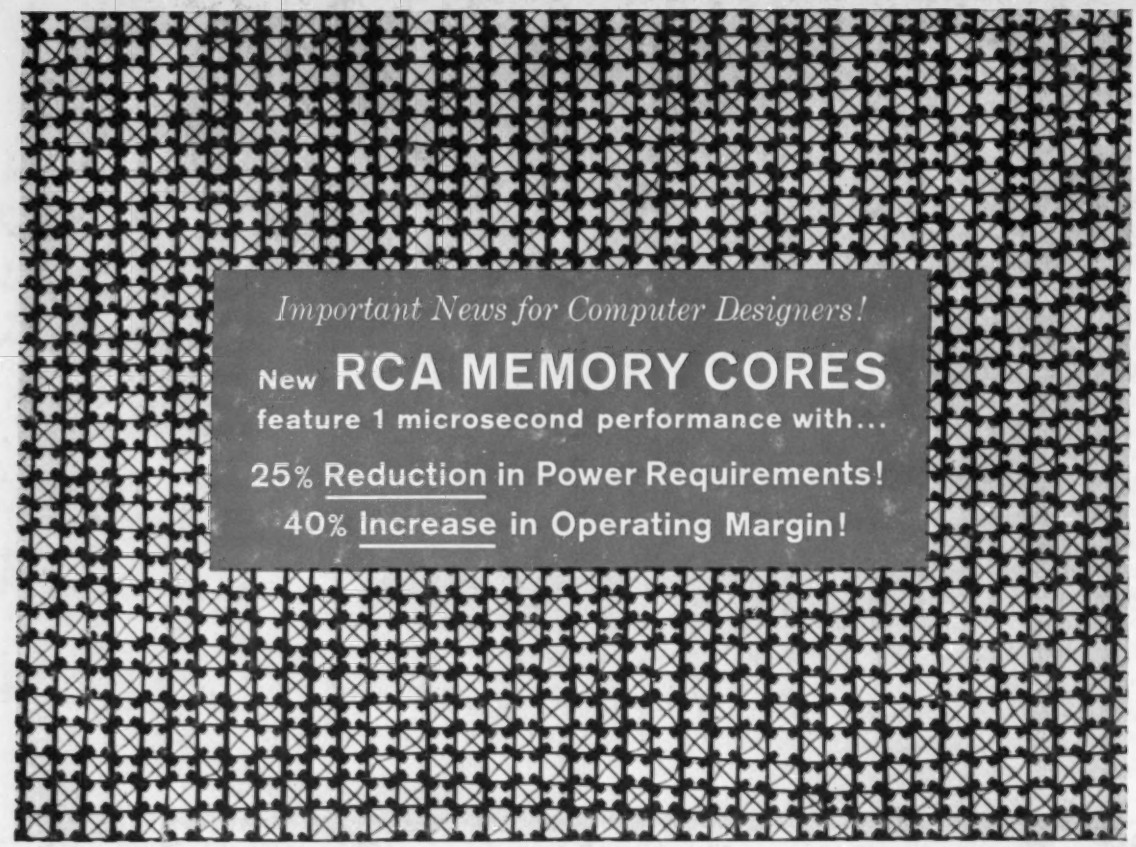

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New 1-μ sec memory cores 226M1 (XF-4028) and 228M1 (XF-4257) developed at RCA's Materials Lab in Needham Heights, Mass., represent an important step forward in ferrite core design for military and commercial computers. See chart for the significant improvements in power requirements and operating margin now possible in 1-μ sec operation.

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NOMINAL OPERATING CHARACTERISTICS AT 25°C

Type	Size	Full Driving Current (Im) (ma)	Partial-Write Current (Ipw) (ma)	Pulse Rise Time (T_r) (μsec)	Switching Time (T_s) (μsec)	Response	
						"Undisturbed 1" (μV_1) (mv)	"Disturbed 0" (dV_z) (mv)
228M1 (XF-4257)	.080" x .050" x .025"	620	310	0.2	1	160	18
226M1 (XF-4028)	.050" x .030" x .015"	380	190	0.2	1	75	10

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